Pit and Quarry

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Sand and Gravel Producers Get Together and Discuss Important Problems

THE Thirteenth Annual Convention of the National Sand and Gravel Association, which was held at the Hollenden Hotel, Cleveland, Ohio, on January 9th, 10th, and 11th, was attended by approximately four hundred members and guests. These came from almost every state in the Union and from Canada, some intent on acquiring useful information, some on renewing old friendships and making new ones and some on having a good time. Whatever their individual purposes in attending, all agreed that the Convention was a success and that the next one, no matter where it was held, would be an even bigger and better one.

Much of the credit for the success of this Convention was due to the untiring efforts of Hal G. Knight, general chairman; V. P. Ahearn, executive secretary; C. E. Glander, chairman of the entertainment committee; Clarence E. Ehle, chairman of the publicity committee; Norman Callahan, chairman of the registration committee; David G. Callahan, chairman of the exhibit committee, and Mrs. Frank Aulenbacher, chairman of the ladies' entertainment committee.

The program of speakers was well arranged and very well received. The papers presented were on subjects of vital interest to most of those present and some of them created a great deal of discussion. The machinery exhibit was the largest to date and although some of the last year's exhibitors were missing, a number of new ones more than made up for their loss. The exhibit was well attended and the number of unusual and interesting features caused considerable comment. The annual banquet was very well attended, as was the dance held immediately following. A number of musical and dancing acts presented during the evening met with great favor.

The program of special entertainment for the ladies was pronounced a huge success—thanks to the ladies' entertainment committee, which consisted of Mrs. Frank Aulenbacher, chairman; Mrs. Clarence E. Ehle and Mrs. Norman Callahan. On Wednesday morning the ladies were received by Mrs. Hader Johnson, official hostess, and at two o'clock in the afternoon were entertained at a tea in suite 100 of the Hollenden Hotel. On Thursday morning they were taken for a trip through the Federal Reserve Bank of Cleveland, and then to the observation tower of the new Union Terminal Building, which is the second highest building in the country. Thursday noon luncheon was served at the Cleveland Art Museum, followed by an inspection trip through the museum. Later a sightseeing trip was taken through some of the parks and boulevards of Cleveland, including a stop at the famous Shakespearean Garden. Friday morning, the ladies were taken on a personally conducted shopping tour and to the Bell Telephone Company of Cleveland, where they viewed one of the largest automatic telephone systems in the world.

Friday afternoon they were guests of the Association at Keith's Palace Theater and at the conclusion of the performance were taken for a tour back-stage, where they were shown the intricacies of the theatre. This closed the official program of entertainment.

Convention Wednesday

President R. C. Fletcher called the convention to order Wednesday morning, January 9th, with a cordial welcome to all those present. He then introduced W. R. Hopkins, City Manager of Cleveland, who extended the official welcome of the city to the Convention. Executive Secretary V. P. Ahearn then took the chair and acknowledged the presentation of a beautiful bouquet of flowers to the Convention from the National Slag Association. He then made a few routine announcements and introduced Dr. Hugh P. Baker, Manager of the Trade Association Department, United States Chamber of Commerce.

Dr. Baker extended greetings from the National Chamber of Commerce and then entered into a discussion of the problems and difficulties besetting trade associations in general. He also told of the work of the Chamber which is backed by about 1,500 organizations throughout the country, and traced the history of trade associations from the

time of the Roman Empire to the present day. He also stressed the importance and necessity of the trade association in present day business and gave as the principles on which they must be based, sound cooperation and mutual confidence. His definition of such an association is "A trade association is an organization of business men in and serving an industry or trade for mutually helpful service and for better business." Particular emphasis was laid on the necessity for an association to give service to its members in meeting their daily business problems as well as their larger general problems. He also suggested that for the fifteenth convention a careful analysis be made of the results accruing to the industry from fifteen years of organized work.

A joint luncheon of producers and machinery exhibitors was held at noon on Wednesday. J. L. Shiely was chairman, and in his own inimitable style introduced a number of prominent producers and others associated with the industry. An after-dinner speaker then cooperated with Mr. Shiely in instilling a spirit of informality and good feeling among those present. At the conclusion of the luncheon H. S. Davison, chairman of the manufacturers division, officially opened the machinery exhibit.

The Board of Directors held a meeting on the

Thirteenth Annual Banquet

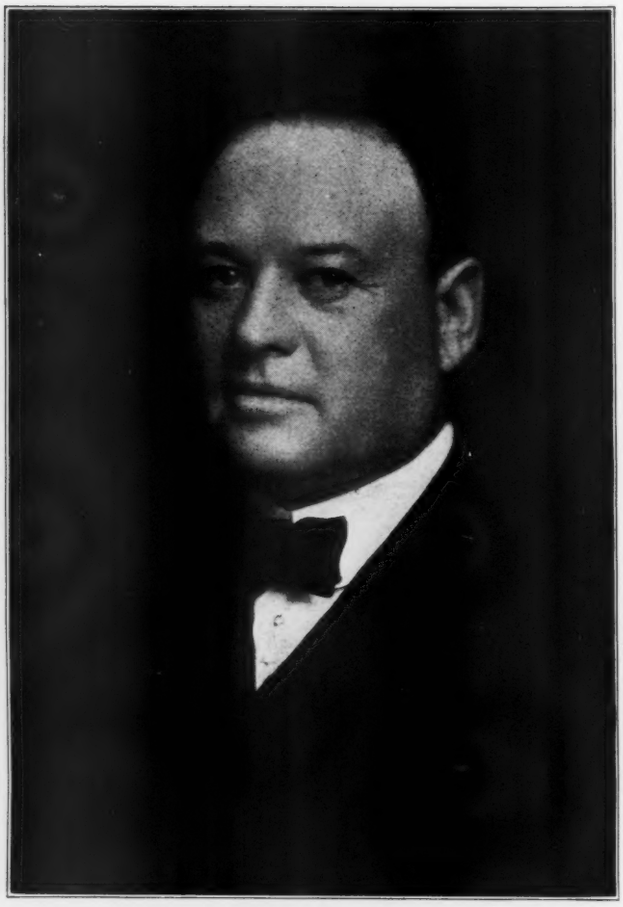
afternoon of January 9th. Among the matters considered was a revised scale of membership dues to become effective March 1, 1929. This scale fixed a minimum at $50.00 per year and up, according to tonnage produced. The present rate of income was fixed 10 years ago, since which time there has been an increase of over 186 per cent in tonnage, with an increase in value of 152 per cent. The new scale is expected to produce an income of about $47,000 annually and will result in the executive secretary being able to spend more time in the field, keeping in touch with the problems of the industry.

An amendment to Section 3, Article 3 of the Constitution was also recommended. The nominees for officers and members of the Board were then reported and were later approved and elected by the convention. R. C. Fletcher was re-elected president. F. D. Coppock was re-elected vice-president and H. S. Davison was elected secretary-treasurer. R. J. Potts, H. V. Owens, and F. W. Peck were elected to the executive committee, and J. C. Buckbee was elected to fill the place left vacant by Mr. Davison.

Thursday Session

The meeting was opened Thursday morning by Executive Secretary V. P. Ahearn, who discussed several routine matters and mentioned the various

in Hollenden Hotel, Cleveland



R. C. Fletcher
Re-elected President

John Prince
a Past President

papers to be presented during the convention. He then briefly summarized his annual report; after which President Fletcher introduced Stanton Walker, director of the Engineering and Research Division, who also briefly summarized his annual report. President Fletcher next introduced J. A. Heaman, Chief Engineer of the Grand Trunk Railway, who presented a paper on "The Use of Gravel as Railroad Ballast." An abstract of this paper is presented elsewhere in this issue.

Thursday afternoon President Fletcher introduced Major Theron M. Ripley, Chief Engineer, Greater Motorways System, Erie County, New York. Major Ripley presented a paper on "Two Course Concrete Pavements," with slides illustrating the subject, which met with unanimous approval and created considerable discussion. This paper is also presented elsewhere in this issue. Mr. Ahearn then read a telegram from Otho Graves, president of the Crushed Stone Association, sending his best wishes to the convention.

President Fletcher then introduced John Prince, a past president, who presided at the remainder of the meeting. Mr. Prince introduced Norman Beggs of the Portland Cement Association, who presented a paper on the "Manufacture, Delivery and Sale of Ready-Mixed Concrete," which is also re-printed. This paper was illustrated with a number of slides showing ready-mixed plant installations and trucks, both with and without agitators, for delivering concrete. This subject created great interest and was responsible for the largest attendance at any meeting of the convention.

A discussion of Mr. Beggs' paper followed. A. W. Dann of the Keystone Sand and Supply Company, Pittsburgh, Pennsylvania, stressed the fact that sand and gravel producers are the logical producers of ready-mixed concrete. His reasons for this are: The available supply of raw material, the plant property ideally situated for the distribution of ready-mixed concrete, and the fact that trucks for hauling this concrete can also be used for hauling aggregates.

Alexander Foster, Jr., of the Charles Warner Company, Philadelphia, Pennsylvania, endorsed the use of trucks which can haul either raw aggregates or concrete, thus cutting down the truck time loss and the admixture of lime with the concrete to prevent segregation and loss of workability enroute to the job. Mr. Foster also asserted his belief that several small mixers can be operated more economically than one large one because of the sporadic demand.

Stephen Stepanian of the Arrow Sand and Gravel

Company, Columbus, Ohio, discussed the comparative economies of ready-mixed and job-mixed concrete and gave a number of arguments in favor of the former. He is a firm believer in the future of this new industry.

A. A. Levison of the Blaw-Knox Company, Pittsburgh, Pennsylvania, showed slides of a number of ready-mix plants which are now in operation. He also stated that for success of this industry the plants must produce a high quality of concrete and must have good delivery facilities.

J. E. Burke of the Ready-Mixed Concrete Company, Pittsburgh, Pennsylvania, described a plant operated by his company which handles its cement by the Fuller-Kinyon system. He also said that for winter operations the concrete must be heated at the plant to from 82 to 86 degrees to insure delivery into the forms at 70 degrees.

Mr. Prince then announced a meeting of the Board of Directors at breakfast Friday morning and the meeting adjourned.

Friday Meeting

President Fletcher opened the meeting on Friday morning, January 11th. Mr. Ahearn said that his report had covered the results of investigations of the Committee on Expense Involved in Cleaning and Repairing Railroad Cars by Sand and Gravel Industry, of which J. C. Buckbee is chairman, and that for this reason the report would not be read. Mr. Ahearn then introduced J. L. Richmond, chairman of the Committee on Marine Compensations Insurance. Mr. Richmond gave his report to Mr. Ahearn, who read it to the meeting. This report is presented as given.

Judge W. W. Ward, Head of the Government Commission on Workmen's Compensation, Washington, D. C., discussed the present compensation laws and the work of his commission. He advocated complete coverage of all employes at a lower cost to employers and said that he hoped to have changes in the present laws made in Congress this winter to simplify insurance.

Mr. Ahearn then gave the report of the Board of Directors, which has already been presented. Hugh Haddow, Jr., reported the new officers nominated. These were unanimously accepted and elected by the Convention. It was then decided to hold the afternoon session immediately.

Mr. Ahearn briefly reviewed the work of the Committee on Standard Depreciation Scale, after which President Fletcher introduced H. G. Taylor, manager of the Public Relations Section, American Railway Association, who discussed "Transportation in Its Relation to Business." He told how, as a result of the work of his section in centralizing the control of freight cars, 161,775,000 tons of road material were shipped in 1927 as compared to

F. W. Peck
of the Executive Committee

98,700,000 tons in 1920, with practically no increase in the number of cars used. He also stated that in 1921 there were 995,000 open top cars in use of which 14 per cent were badly in need of repairs, while in 1928 there were only 966,000 cars in use, of which 7 per cent needed repairs. This was in spite of the fact that the total of cars shipped had increased more than 1,000,000, with an increase in tonnage of more than 64 per cent. Credit for this, according to Mr. Taylor, was due not only to the centralized control of his section, but also to the improvements which have been made in tracks, cars and terminals, and to the heavier loading of cars. The average load of sand and gravel in 1927 was 51.7 tons per car as compared to 47.1 tons in 1920.

W. W. Adams of the United States Bureau of Mines then presented a paper on the "Benefits of Safety Campaigns in the Mineral Industries," in which he told of the work done in this field by the Bureau.

Mr. Stepanian then read the report of the Committee on Standard Specifications. Both this re-

Hugh Haddow, Jr.

port and Mr. Adams' paper will be published in an early issue of Pit and Quarry. President Fletcher then adjourned the meeting, closing the convention.

V. P. Ahearn's Report

Executive Secretary V. P. Ahearn presented the following report:

It is by no means an easy task to incorporate in the annual report of the executive secretary a comprehensive history of the activities of the National Sand and Gravel Association during the year 1928. While in other years it was found expedient for the organization to concentrate its efforts on the accomplishment of a single objective, the past year has witnessed a succession of problems involving the interests of the sand and gravel industry, each of which did not yield to the others from the standpoint of importance to the membership.

Before proceeding to an account of the principal activities of the Association, it is considered desirable to refer to the general condition of the organization so far as stability and financial standing are concerned. It is a source of gratification to be able to report that new memberships have been secured in 1928 which represent more tonnage than has ever been added to the Association in any comparable period. These new members have given renewed strength to the organization and have made possible a broadening of its efforts in behalf of the sand and gravel industry. A more complete discussion of membership matters will be made later on in this report.

We are able also to report a healthful financial condition. The Association is solvent in every meaning of the word and is completely free of all indebtedness. However, during the course of the year it became the conviction of the Executive Committee that a revision of the present basis of dues was necessary in order that the requirements of the Association during the immediate future might be met. The scale of dues now in effect was fixed some ten years ago when the size and industrial importance of the sand and gravel industry was considerably less than it is today. During this period the annual production of sand and gravel has increased from 70,576,407 tons to 197,454,269 tons, an increase of 180 percent; the value of the annual production of these materials has increased in this time from $45,951,556 to $115,529,786 in 1927, an increase of 152 percent.

Demands for Association service have increased in direct proportion to the rapid growth of the industry since the creation of the organization, but this has not been accompanied by a proportionate increase in income, due principally to three factors: First, dues are not assessed on productions in excess of 600,000 tons annually. Second, the several instances of mergers of member companies. Third, disbanding of state and district associations which were members of the National Association as a body.

The scope of activities of the Association was considerably broadened at the beginning of 1926. At that time the Engineering and Research Division was established in answer to an insistent demand from the membership for work which this Division could perform in personal service to the membership, in the promotion of the use of prepared materials, and in representing the sand and gravel industry before national engineering bodies interested in specification problems.

As this Division began to function, it soon became apparent that, in order for its full effectiveness to be realized, it was essential that a research laboratory devoted to the problems of the sand and gravel industry should be established at Association headquarters in Washington. Authorization for such an expansion in Association activities was given at the 1927 convention. A full description of the laboratory will be found in the report submitted by Mr. Walker.

The Board of Directors of the Association has been requested to make a study of the situation with a view to recommending to the membership as a whole what changes, if any, should be made in the prevailing scale of dues. This will undoubtedly be ready for presentation to the 1929 convention, at which time it is hoped that a final decision will be reached with respect to appropriate action.

The Bulletin

The National Sand and Gravel Bulletin has enjoyed a most successful year. From a steady source of expense to the Association it has been transformed into a substantial source of revenue, without sacrificing, in the slightest degree, any of the

high standards which have always marked its publication. Indeed, during the last two years the circulation of The Bulletin has been increased approximately 50 percent and the size of the publication has been enlarged.

It is our intention, as conditions permit, to increase still further the circulation of The Bulletin. We are justified in stating that it fills a most vital need of the established sand and gravel industry and the Association, for it fulfills the function not alone of keeping producers informed with reference to current affairs of direct interest to them, but it also provides a means of regular contact with agencies and individuals which represent the principal markets for sand and gravel.

The Annual Convention

The machinery and equipment exhibit is now installed as a regular feature of the conventions of the Association. It is readily evident that this feature has increased the interest of the convention and has been responsible for a much larger registration of producers than at the former annual meetings of the organization.

In addition to providing a source of unequaled educational advantage for the superintendents and the operating men of the sand and gravel industry, the exhibit has the added advantage, due to the requirement that only members of our Manufacturers' Division are privileged to participate in the exhibit, of adding greatly to our list of associate members. Prior to the adoption of the exhibit plan, our associate members totaled only four companies; at the present time they number well over fifty. The resultant increase in income has enabled the Association to defray the cost of its annual conventions, an item which attained considerable proportions in the past.

Prospects for 1929

While the preliminary reports of the U. S. Bureau of Mines covering the production of sand and gravel in 1928 are not yet available, it is not anticipated that there will be a substantial difference between the total for that year and the preceding year. During the year just closed there were some sections of the country which suffered a drop in demand for sand and gravel as compared with 1927, but this was offset by heavy increases reported in other territories, especially in localities where extensive highway programs were being carried out.

There are two markets for our materials which are rapidly forging to the front as principal consumers; and these are the use of gravel for railroad ballast and for the construction and maintenance of gravel roads. According to the Bureau of Mines, 28,541,924 tons of gravel were used for ballast by the railroads in 1927, an increase of over 25 percent as compared with 1926. These are figures which reveal the success of the industry's efforts to convince the railroads of the merits of gravel as a ballast material.

V. P. Ahearn

The U. S. Bureau of Public Roads estimates that there are more than three millions of miles of roads in the United States at the present time, not including the many miles in cities and towns. Of this 3,000,000 miles only about 615,000, or 20 percent, are surfaced, and of this improved mileage approximately 60 percent is classified as gravel construction. Even in the state highway systems alone, where about 60 percent of the total mileage is surfaced in some manner, the gravel road represents almost one-half of the total surfaced mileage. This information is of great significance to the established sand and gravel industry, for it points out a path of more intensive development in the future and directs our attention to a market, long ignored and allowed to escape through default to the wayside pit, which offers tremendous possibilities as a means of absorbing the increased output of our plants.

Preliminary data compiled by construction economists seem to indicate that contracts awarded in 1928 will exceed 1927 by about 6 percent, and all authorities seem to be in agreement that building will continue in large volume because business conditions in general will be satisfactory. It is axio-

matic that a healthful economic condition in the country is accompanied by brisk activity in building. A second reason for anticipating a continuation of a large volume of construction is advanced by B. F. Affleck, President of the Universal Portland Cement Company. He points out that while we have overcome the shortage following the war, current needs, year by year, are so great that large scale building is necessary. Our population increases at the rate of about 15 percent during a ten-year period. In the coming decade we must provide, therefore, for 18,000,000 more people than we have today. That will mean more highways, more streets, more public facilities of all sorts, and more of every type of construction.

Problems of the Industry

There can be no doubt that the sand and gravel industry is suffering from a plant capacity considerably in excess of any normal demand for its products, taking the country as a whole into account. However, all the problems of our industry cannot be attributed solely to excess capacity, for the real trouble lies deeper than that. While overproduction is an easy explanation of the difficulties, it is too often used to justify selling below the cost of production and extreme tactics of competition. The real cause of disordered price situations is to be found, therefore, not in an unreasonable expansion of plant capacity, but in the grasping for volume to use that capacity.

It has been shown that up to a certain point price competition tends to force producers to improve their methods in order to reduce costs and to raise quality, but beyond that point more intense competition tends to decrease quality and service. In the long run the public loses by price competition, no matter how much it may apparently save for the time being. Ruinous competition can be eliminated only by curtailing the desire for volume production at any cost, a symptom of industrial sickness which has been fancifully called "volumitis." The only cure is the scientific quoting of prices based on actual cost plus a reasonable profit; it does not involve price-fixing in the slightest degree.

Some business leaders have advocated that the anti-trust laws be amended to permit manufacturers to combine in selling, but the majority opinion is that political and legislative action offer no remedy. The courts and the legislatures are not the places for fighting the battles of business, for industries must cure their own evils without invoking the drastic interference of the instrumentalities of government.

Value of Cooperative Research

While more complete details regarding the establishment and policies of the research laboratory of the National Sand and Gravel Association are contained in Mr. Walker's report, opportunity is taken of the advantage to urge members to consider carefully the full significance of this new branch of the activities of the organization. The sand and gravel industry must prepare itself for the future by carefully directed research, for too many of the developments in the wide uses of our materials have come not from the producers, but from the consuming industries.

It is our duty to know more about our materials than anyone else, for that is the only assurance for retention of our present markets. The two weapons for doing this and for the winning of new markets are research and education. Too many other industries have been lulled into a false sense of security by a conviction that they had been endowed by Nature with certain markets which none other would dare to invade, but they were awakened rudely to the realization that research and scientific progress by other groups had caused them to lose their hold.

An article appearing recently in Nation's Business gives an interesting description of how trade associations are putting science to work. It was stated that many problems now confronting industry are so complex that their complete solution involves an expenditure of time and money which few, if any, individual manufacturers feel justified in spending. In supporting the research program of the National Association, the individual producer surrenders none of the advantages which he may enjoy as a competitor in his field, since the benefits to be derived from the new truths established depend almost directly upon the ability of his own organization to apply to his own work the data thus secured. Modern industry is specializing in education and a new era of salesmanship has dawned.

Car Supply in 1928

The transportation requirements of the sand and gravel industry during 1928 were handled in an entirely satisfactory manner by the railroads, and we are again indebted to the American Railway Association for their co-operation in relieving the comparatively few cases of car shortage which were brought to the attention of our Association by the membership. The only serious threat to uninterrupted service was the possibility of a strike on western railroads. Action was taken by the Association to protect the interests of its members in the western territory, and a petition was filed with the U. S. Board of Mediation in behalf of the sand and gravel industry, urging that steps be taken to settle the dispute between the carriers and the trainmen in order that our industry might not be crippled with a car shortage during the peak-loading months of September and October.

Attention of the membership is directed to the fact that car service rules require that railroad equipment, when its contents are unloaded, must be returned to home lines. Some carriers are known to be short of open top equipment, but this does not give them the privilege of retaining indefinitely the cars of other railroads. If an actual shortage of car supply is encountered, or if a shortage seems imminent, it is urged that the facts be brought to the attention of the National Association for handling with the proper authorities. We can assure every member company definitely that steps will be taken promptly to afford them relief.

Personal Service to Members

We have frequently suggested to members that one of the outstanding privileges accruing from membership in the organization is that of calling on the Washington Office for personal service and assistance to members in individual problems which may arise from time to time. Our files disclose that more requests of this nature were received in 1928 than in any previous year, and we wish to encourage members to take even more advantage of our personal service facilities in 1929.

The Association retains commerce counsel and income tax counsel for the use of its membership. The former is in a position to advise members concerning questions of a traffic nature; and our tax counsel is qualified to advise them on all details of tax procedure. In many cases members have been saved the time and expense involved in making trips to Washington on tax matters, and the organization has performed such duties as arranging hearings before the Bureau of Internal Revenue, securing extensions of time for filing tax returns, ascertaining the status of long-delayed tax appeals, advising members as to their rights under the income tax law in specific cases presented for our consideration, and in many other ways.

Each request for personal service received during 1928 was handled promptly and results achieved. It is regrettable that space forbids a complete enumeration of each case, for the value to the members in question is readily evident and the requests are most interesting because of the wide variety in their nature. We cite below some typical examples of personal service rendered by the organization:

Rates of depreciation on sand dredges and steel barges; information regarding proper rates for workmen's compensation insurance; data for use in addresses before Rotary Clubs; approximate consumption of sand and gravel per capita by years in principal cities of the United States; information with respect to general depreciation practices in the sand and gravel industry; application of Federal Longshoremen's Act to marine sand and gravel producers; publicity material pertaining to gravel for road repair and maintenance work; information as to liability of bonding companies for unpaid freight charges on shipments of sand and gravel for highway work; ascertaining status of formal complaint before Interstate Commerce Commission; data regarding trend of building costs since 1913; request for telegraphic advice concerning awards of Government contracts; information relative to policy of producers in other sections of country as to allowances for moisture content in sand; names of parties competent to make survey of sand and gravel properties; assistance in organizing local association of sand and gravel producers; data concerning liability of carriers for expenses incurred in repairing unsuitable cars; procedure for securing proper depletion allowances in tax returns; information concerning costs of producing sand and gravel; general accounting practices in sand and gravel industry.

Association Activities

Some of the more outstanding activities of the Association may be grouped conveniently into various committees of the organization which have had charge of carrying out the instructions of the Board of Directors so far as their particular tasks were concerned. The work of each of these committees has a direct and intimate bearing upon every member of the organization, and we are indebted in a large degree to the members of the committees who have given of their time in order to insure the successful accomplishment of the duties which were assigned to them.

Cleaning and Repairing Railroad Cars

As a logical consequence of the paper delivered at the last convention of the Association by J. C. Buckbee on the subject of cleaning and repairing railroad cars placed for loading at sand and gravel plants, the Executive Committee decided to appoint a committee to represent the Association in working out this problem with the carriers. Mr. Buckbee was named as chairman of the committee.

Some of the significant facts brought out by Mr. Buckbee in his paper are that the sand and gravel industry is spending annually about $1,500,000 for placing cars in condition for loading. Taking as an illustration the case of a concern shipping 5,000 cars annually, Mr. Buckbee estimated that the expense of cleaning and patching cars would cost the producer about $2,800 each year, or, considering his season of operation to be eight months, $350 per month.

Questionnaires were sent to producers for the purpose of securing information which would be of assistance to the committee in its negotiations with the American Railway Association for an improve-

ment in present conditions. The data thus furnished has been incorporated in a report, copies of which were mailed to all producers. The report of the sand and gravel industry, together with similar reports prepared by the National Crushed Stone Association and the National Slag Association, will be submitted to the railway authorities at a conference to be held at any early date. It is expected that at that time a program will be adopted, satisfactory both to the shippers and carriers, which will tend to relieve our producers of a burden of expense which they should not be called upon to assume.

Compensation Insurance for Marine Operations

Compensation insurance for marine sand and gravel producers has been a matter of considerable concern on inland waterway operations, particularly since the passage of the Federal Longshoremen's Act. Most of these producers have depended upon compensation insurance through the states in which they are located. But since the passage of the legislation referred to above, it has developed that state insurance does not afford full protection for all employees in river operations.

Under present court rulings, marine producers have to assume risks under three separate and distinct laws: State compensation for forces working entirely on shore; Federal Longshoremen's insurance for employees working between shore and water, assisting in unloading barges; and a third liability under the Admiralty Act for all employees working on floating property.

A paper on this subject by J. L. Richmond at the last convention prompted the appointment of a committee to make the necessary investigations with a view of recommending a course of procedure which would enable marine producers to concentrate all of their liabilities in one policy, as otherwise excessive insurance rates are incurred and confusion is created. This committee has prepared a constructive report which will be submitted at the present convention, suggesting the adoption of a program which will clarify the conditions of which complaint is made.

Standard Depreciation Scale

As a means of supplementing depreciation studies conducted by George A. Rogers, a report on which was presented at the last convention of the Association, a committee was appointed by President Fletcher, with Mr. Rogers as chairman, for the purpose of bringing about the establishment of a standard scale of depreciation rates for the sand and gravel industry.

This program was adopted as the result of an invitation extended to the Association by the Commissioner of Internal Revenue to co-operate with his department of the Government in studies of depreciation and maintenance, with the objective of reaching an agreement on standard and basic depreciation rates applicable to sand and gravel properties. Similar invitations were extended to associations representing other industries.

The results which are anticipated from studies of depreciation and maintenance are greater equity in the collection of income taxes imposed by the several Revenue Acts, and simplification of the preparation and audit of tax returns with consequent saving of material amounts both to the taxpayers and the Government. An important secondary consideration will be the saving of substantial sums to the taxpayers and the Government through the elimination of avoidable disputes. It is obviously impossible for several thousand income tax auditors and revenue agents to exercise similar judgment in the review of tax returns, particularly as they have probably not had the advantage of experience in the industry for which they are auditing or examining a tax return.

The Executive Committee anticipates that the determination and publication of standard rates of depreciation will be even more important for other business purposes than for the preparation of tax returns. One service will be to make information available for the members of our industry who are making inadequate provision for depreciation. There may be some who do not consider depreciation in computing production costs and selling prices, making them undesirable competitors before they are eliminated by capital consumption and credit exhaustion. It has been a recent practice of many fire insurance adjusters to ask for a copy of the last income tax return as an aid in computing depreciation rates in connection with fire losses; banks are requiring careful analyses of depreciation accounts with respect to financing; and other phases of normal business activity will be benefited by published standards of depreciation based upon the aggregate experience and opinion of the industry.

In order to provide for a more efficient collection of the necessary data, Mr. Rogers decided to divide his committee into various sub-committees, each representing a different type of sand and gravel operation. Reports have been received from these sub-committees and they will be prepared for distribution among the entire sand and gravel industry, requesting criticism of the rates named for each piece of equipment. When this procedure has been completed, a final report will be presented to the Bureau of Internal Revenue as the recommendations of the Association for standard depreciation rates in the sand and gravel industry. The Bureau will then, in turn, re-submit the proposed scale to the individual members of the industry on its own behalf, inquiring as to whether there are

any objections to making the rates standard. When the Bureau has given its stamp of approval to the rates, the final step will be publication by the Government of a standard scale which will apply to the sand and gravel industry.

It should be pointed out that the scale of depreciation rates for the sand and gravel industry agreed to by the Bureau of Internal Revenue will not be an arbitrary scale. It may be used by the individual producer in its entirety and it will be accepted by the Bureau without question; but if the producer feels that his particular operation justifies rates either higher or lower than those named in the scale, there is nothing to prevent him from setting up such rates in his tax returns. Of course, he will be expected in circumstances of this kind to submit evidence which supports the rates he has claimed.

Bulletin Supplement

During the past year the Bulletin Supplement has been published at regular intervals. Its circulation is confined to the membership and its purpose is to keep them accurately and promptly informed as to all matters affecting the industry. A new department has been added to the supplement in the form of a construction news service, designed to furnish comprehensive data with respect to monthly building activity in all sections of the country. In this manner our membership are regularly informed concerning the amount of building operations in their own territories and in the country as a whole.

Meetings of Board of Directors and Executive Committee

The Executive Committee of the Association held four meetings in 1928, and the Board of Directors met for the regular summer meeting in Chicago during the latter part of May. In this way constant contact was had with the work of the Washington Office and decisions were made with respect to Association policies on various matters. All of the standing committees of the organization held sessions in Chicago at the time of the meeting of the Directors.

It will be remembered that consideration was given at the meeting of the Board of Directors in Detroit at the time of the 1928 convention, to a proposal for moving the headquarters of the Association from Washington to Chicago, or to some other more central location. The Board instructed the Executive Committee to investigate the circumstances thoroughly and to make a decision with respect to the comparative advantages of Washington and Chicago for conducting the business of the organization.

At a meeting of the committee in Washington on February 9, opportunity was had for a first-hand study by the Executive Committee of the manner in which the staff of the Association represents the sand and gravel industry before the different departments of the Government. After a complete study of the matter, the committee was convinced that headquarters should be retained in Washington, on the basis that it would be inadvisable for the sand and gravel industry to lose the contacts which the Association has made in national headquarters. It was felt that such contacts would not be outweighed by the closer proximity to the major part of the industry which a location in Chicago would offer.

Association Membership

It is estimated that there are 1,500 trade associations in the country, about half of which are national in character. Every major industry has an organization of its own, a fact which provides a means for each to co-operate with the others in problems of mutual concern. Our Association has regular sources of contact with organizations representing various consumers of our materials, and our assistance has been requested by such organizations in furnishing data and information with respect to proper uses of sand and gravel, and on other matters as well.

A trade association has been defined as an organization of men in serving industry for mutually helpful service and for the promotion of better business conditions. But it is perfectly plain that an association must include within its membership a majority of the producers engaged in the business if it is to represent the industry to the best advantage. Furthermore, it is proper that every producer should bear his share of the expense of the organization, since all share alike in the benefits accruing from the general service performed by the association. In addition, the money paid as dues by one member is rendered effective in direct ratio as it is supplemented by dues paid by other firms, and the only factor which will limit the efficiency of the Association is that of inadequate support from the industry.

With the proper support from our industry, the Association will be so organized that its full potentialities as an educational force will be realized; it will keep the membership posted concerning best methods of operation and business practices; it will broaden its present co-operation with the engineer and architect in perfecting specifications which will extend the use of high-grade aggregates because of their ultimate economy; it will be able to furnish the contractor with more complete information as to the proper use of the products of the sand and gravel industry. These are the things which must be done if we are to keep abreast of other industries of a national scope.

It is possible to condense into a few words the logical basis for existence of the Association:

1. Unity in any line of business means strength to the individual.

2. The accumulation of individual strength means power to the organization.

3. Intelligent direction in the use of power means inevitable progress and success.

Division of Duties of Executive Secretary

It is only natural in any organization of a national character that there should be a volume of correspondence which requires varying degrees of attention. The Association has been in existence for over twelve years and some of its work is now so well established upon certain definite lines that it is possible to summarize some of the duties which come under the supervision of the executive secretary. Without endeavoring to give a complete and detailed description of the functions which he must perform in the regular order of business, we are setting out below an outline of the existing division of duties:

1. Executive Secretary of the Association and Editor of the National Sand and Gravel Bulletin.
2. Secretary of committees of the Association and secretary of the Manufacturers Division, the latter being composed of all associate members.
3. Supervising annual convention arrangements and handling of details of exhibition of machinery and equipment.
4. Handling general correspondence of Association, including the preparation of records pertaining to business meetings of the organization.
5. Attendance at meetings of state and district associations of the sand and gravel industry, together with miscellaneous traveling for visiting members' plants and for the purpose of being present at meetings of the Board of Directors and the Executive Committee. In this connection, the records reveal that the Executive Secretary spent 75 days in the field during 1928 and traveled 21,871 miles.
6. Responsibility for finances of the Association, this involving the collection of dues from active and associate members and the disbursement of funds subject to the approval of the Treasurer.

It would be desirable, if possible, to devote more time to several of these duties, with particular reference to management of The Bulletin. This is an assignment which might well occupy the sole time of one man, but at the present time it is necessary to arrange our activities in such a way that each task receives as much attention as can be given to it.

The staff of the division of the Executive Secretary consists of the following: V. P. Ahearn, Executive Secretary. Milda M. Himmler, who is manager of the office and in charge of the accounting department. Ruth V. Fowler, who renders stenographic assistance and is in charge of the files and the mailing list. Florence Isenberg, who is also a stenographer and who divides her time between the Executive Secretary's division and the Engineering and Research Division.

Conclusion

With the end of the calendar year of 1928, the National Sand and Gravel Association completed the twelfth year of its existence as the official representative of the established sand and gravel industry. During that time the industry has grown from a small, un-co-ordinated business into one of large proportions with a nation-wide investment which is estimated to be five hundred millions of dollars. This growth has not been casual nor has it been the process of any natural evolution; it is directly attributable to the energy of the men who are the pioneers in the business and to the educational forces which they set in motion for demonstrating the economy that lies in the use of properly prepared materials. The Association has played a most important role in the development of the industry from an obscure factor in the industrial life of the nation to the status of an essential industry. We look forward confidently to the future, with the belief that the enlarged facilities of the Association will make it even more valuable to the membership.

In concluding this annual report, it is desired to give expression to the feeling of obligation shared by every member of the staff of the Washington Office for the generous co-operation and assistance which have been received from member companies during the past year, without which our efforts to be of service would have been of no avail.

Stanton Walker Report

The Report of the Engineering and Research Division was made by Director Stanton Walker and is reported in full as follows:

The Engineering and Research Division has passed through the busiest and most satisfactory year since its organization. The Research Laboratory, which has been discussed in previous reports, has become an accomplished fact. The broadening of the scope of the work by the addition of the Research Laboratory, more extensive and diversified distribution of information, increased correspondence, and the many other activities which accumulate with time in any active organization, has resulted in accomplishments which have been of definite benefit to the industry.

In this report the more important activities of the division are summarized. Each member of the Association should read it with considerable care, since it offers the only means available to most of you for gaining a fairly intelligible picture of our work from which a realization of its value to the industry can be obtained.

In reading the report it should be kept in mind,

TABLE 1. LIST OF PUBLICATIONS OF ENGINEERING AND RESEARCH DIVISION.

Bulletin 1. "Estimating Quantities of Materials for Concrete."
Bulletin 2. "Relation of Aggregates to Concrete."
Bulletin 3. "Representative Specifications for Different Uses of Sand and Gravel."
Bulletin 4. "Tables of Quantities of Materials for Concrete."
Circular 1. "Summary of State Highway Specifications for Sand for Concrete Pavement Construction."
Circular 2. "Summary of State Highway Specifications for Gravel for Concrete Pavement Construction."
Pocket-Sized Loose-leaf Data Sheets:
1. "Summary of State Highway Specifications for Sand for Concrete Pavement Construction." (Same data as Circular 1.)
2. "Summary of State Highway Specifications for Gravel for Concrete Pavement Construction." (Same data as Circular 2.)
3. "Physical Requirements for Sieves for Testing Purposes."
4. "Tables of Quantities of Materials for Concrete." (Data from Bulletin 4.)

first, that the national scope of the Association's work requires the activities of the Engineering and Research Division (and also the Executive Secretary's Division, of course) to cover a considerable number of subjects, and, second, that the relatively limited personnel makes necessary a somewhat thin spreading of effort. This point is brought out since, in reading the descriptions of the various classifications of our work, opportunities for doing a more thorough job may seem obvious. However, it has been necessary to forego many opportunities for increasing the scope of some of the branches of our work to avoid taking the time from others. It is proper to make the general statement that, under present conditions, almost any expansion in one branch of our activities requires a corresponding retrenchment in other branches.

The nearness with which an organization strikes the best balance between the number of activities and intensity of efforts in each provides a good measure of its efficiency. In the report which follows we have endeavored to include enough information to permit you to judge the Engineering and Research Division on that basis.

Outline of Activities

The many different activities which fall within the scope of the Engineering and Research Division have kept the staff more than comfortably busy. These have included the preparation and publication of several bulletins and technical articles, the distribution of 20,100 bulletins or circulars, the writing of an average of ten to twelve letters each working day, traveling about 18,000 miles with attendant absences from the office of slightly more than three months, the establishment, equipment and operation of a Research Laboratory, and the numerous other items which go with the operation of an office. The activities for the past year

Stanton Walker

may be classified roughly under the following subdivisions:

1. Preparation and distribution of literature giving information concerning the use of prepared sand and gravel.
2. Distribution of information through correspondence in response to inquiries received from both those within and without the industry.
3. Distribution of information through talks delivered before groups of engineers, contractors, sand and gravel producers, etc.
4. Cooperation with engineering societies and committees concerned with specifications for sand and gravel.
5. Direct engineering service to member companies.
6. Researches in sand and gravel carried out in the newly established laboratory.

No attempt has been made to state the different classifications in the order of their importance. They will be discussed briefly in the order named.

Personnel

In a field with as many ramifications as that of the sand and gravel industry, the amount of work which can be accomplished depends, for the most part, on the facilities available. It seems desirable, therefore, to preface the discussion of the various activities of the Engineering and Research Division with a brief description of its staff and a statement of the funds available to finance the work.

The staff of the division is composed of six men and women, as follows: Stanton Walker, Director, who exercises general supervision over the work of the Division. C. E. Proudley, Assistant Director, who assists in the general work of the Division and superintends the work of the Research Laboratory. Pearl O. McKim, Secretary, who handles the correspondence, keeps laboratory records, supervises the mailing of literature of the Division and carries out its general secretarial work. Florence Isenberg,

TABLE 2. DISTRIBUTION OF MAILING LIST FOR TECHNICAL BULLETINS.

Classification	No. on List
Sand and Gravel Producers	1600
Miscellaneous Engineers, Contractors, Commercial Laboratories	400
Engineers of State Highway Departments	170
Municipalities and Counties	110
Railroads	51
Government Bureaus	83
Associations, Engineering Societies and Chambers of Commerce	190
Cement Companies and Concrete Products Manufacturers	156
Colleges, Universities, Research Laboratories, Libraries	75
Equipment Manufacturers	170
Magazines	50
Foreign	66
Miscellaneous (other than classified above)	186
Crushed Stone and Slag Producers	53
Total	3350

Stenographer, who spends most of her time mailing literature and handling routine correspondence with reference to it. Miss Isenberg also assists in the work of the Executive Secretary's office. Philip Arnold, Laboratory Assistant, who carries out the work of the Laboratory under the supervision of Mr. Proudly. Robert Casey, Laboratory Aid, who prepares materials for tests and assists in the general work of the Laboratory.

The funds available for the operation of the Engineering and Research Division, during the year, amounted to about $22,000. About two-thirds of this amount came from the general funds of the Association and one-third from special subscriptions to the "Research Laboratory Fund."

Preparation and Distribution of Literature

The preparation and distribution of literature giving authoritative information is one of the most important functions of the Division and it is desirable to discuss this subject in considerable detail. Our steadily growing mailing list and the demands made for additional copies of our publications provide definite evidence of the importance of this phase of our work. That fully half of these requests come from consumers rather than producers of sand and gravel is significant. It is the consumer whom we wish to interest in prepared sand and gravel; the producer is already interested. The number of requests received from foreign countries is an indication of the general usefulness of the publications.

The publications of the Division have been prepared with the idea foremost of making them sources of useful information. In general, they do not consist of directly promotional literature; the most effective promotion of the use of prepared sand and gravel comes from increasing the general knowledge concerning aggregates. Efforts have been made to increase their effectiveness by republishing certain of the information from them

TABLE 3. SUMMARY OF DISTRIBUTION OF TECHNICAL BULLETINS.

Publications	Date of First Printing	No. of Printings	Total number of copies printed	Mailed 1927	Mailed 1928	Stock on Hand
Bulletin 1	Mar., 1927	3	5200	2400	1600	1200
Bulletin 2	June, 1927	4	8900	2400	4500	2000
Bulletin 3	Nov., 1928	1	5000	....	1700	3300
Bulletin 4	May, 1928	2	10000	....	5900	4100
Circular 1	Oct., 1927	3	5000	3200	1300	500
Circular 2	Nov., 1927	2	4000	2900	600	500
Loose-Leaf Data Sheets						
1	May, 1928	2	4000	....	1000	3000
2	June, 1928	2	4200	....	1000	3200
3	July, 1928	1	5000	....	1500	3500
4	Sept., 1928	1	3000	....	1000	2000

on loose-leaf data sheets and also by providing binders for the bulletins. Credit is due Mr. J. C. Buckbee of the J. C. Buckbee Engineering Company and the Northern Gravel Company for valuable suggestions along these lines.

Bulletins 1 and 4, for example, which give information from which the quantities of materials for concrete can be estimated, have proven particularly popular among engineers and contractors. They are valuable reference books and the information presented in them is applicable to one type of aggregate as well as to another. Their value in the promotion of gravel is obvious. The low void content of gravel offers a real source of economy; the intelligent use of an accurate method for calculating quantities is the best means of emphasizing this economy.

Bulletin 2, "Relation of Aggregates to Concrete," summarizes information showing the importance and economy of high quality sand and gravel. Bulletin 3 gives more complete information on specifications for different uses of sand and gravel than has heretofore been incorporated under one cover.

A complete list of the publications is given in Table 1.

The loose-leaf data sheets represent an attempt to present useful data in the most usable form. They were initiated following a suggestion from Mr. Buckbee. In order for their usefulness to be realized, the sheets should be bound in note-book covers. This offers an opportunity for members of the Association to call attention to their company by distributing covers, bearing the name of the company and containing the data sheets, among engineers and contractors in their territory. The note book covers are standard for a 6¾ by 3¾ in. sheet and can be secured at any stationer's. However, this office has offered to secure, at wholesale prices, the covers with the name of the company and the seal of the Association printed on them in gold leaf. While only a comparatively few members have taken advantage of this method of advertising their company, a considerable number

of the data sheets have been distributed in this manner. Thirteen companies have purchased a total of 176 note book covers. Approximately two-thirds of these have been purchased by three companies—the Northern Gravel Company of West Bend, Wisconsin; the J. E. Carroll Sand Company of Buffalo, N. Y., and the Buffalo Gravel Corporation of Buffalo, N. Y. Each cover contained the data sheets and a number of convenient blank forms.

The loose-leaf data sheets have proven particularly popular among field engineers and it is felt that, as times goes on, more members will take advantage of data books filled with them as a means of advertising their company.

The publications of the Engineering and Research Division are distributed to a carefully selected mailing list of about 3,350 names. Not all of them are sent to the entire list, it being attempted to restrict the mailing of each to those most interested in the subject covered. A large part of the list was formed from requests for copies of the various bulletins. When a bulletin is requested it is sent with a card listing all of the publications. This gives the engineer or producer an opportunity to select the bulletins he wishes and also enables us to avoid encumbering our list with uninterested readers.

The list includes, in addition to sand and gravel producers, Federal, State, County, and City Engineers, miscellaneous engineers and contractors, railroads, colleges, cement companies and several other classifications. An understanding of its scope may be gained from Table 2, which gives the different groups and the number of names in each. It does not seem necessary to comment on the desirability of furnishing accurate information concerning the use of prepared sand and gravel to the individuals represented by these classifications nor on the importance of expanding the list as conditions permit.

That the various publications have proven popular is shown by the fact that from 5,000 to 7,000 of some of them have been distributed. These numbers, 60 to over 100 per cent more than the list, indicate many requests for additional copies. Several member companies have secured special editions, with the name of their company prominently imprinted, and distributed them among their customers. Requests for additional copies from heads of engineering organizations, colleges, etc., are common. Table 3 gives the date of publication of each bulletin, the number printed, the distribution in 1927 and 1928 and the number now on hand. Table 4 shows the number distributed in the special editions.

Before passing on from a discussion of the formal publications of the Division, mention should

TABLE 4. DISTRIBUTION OF SPECIAL EDITION OF BULLETINS.

Bulletin No.	No. of Member Co.'s	No. Bulletins
1. "Estimating Quantities of Materials for Concrete"	5	715
2. "Relation of Aggregates to Concrete"	7	3463
4. "Table of Quantities of Materials for Concrete"	6	1214

be made of another policy which has just been inaugurated and which was mentioned earlier in the report. This policy also comes from a suggestion of Mr. Buckbee. It was felt that, in order for the technical bulletins to be of most use, some means for making them conveniently available at all times should be devised. With that in mind, we have had manufactured for us handsome leather binders specially designed to contain the technical bulletins. These binders bear the seal of the Association and the inscription "Technical Bulletins of the National Sand and Gravel Association" stamped on the cover in gold leaf. One binder, containing the bulletins, has been presented to each active member. Additional copies may be had at $3.00 to $5.00 each, depending on the number ordered. The name of the member company may be added at a slight additional cost.

In addition to the formal publications of the Engineering and Research Division a number of miscellaneous articles have been contributed to the National Sand and Gravel Bulletin and to other trade and engineering publications. These are listed in Tables 5 and 6.

The publications of the Division have been supplemented by special mimeographed communications to member companies. Among them may be mentioned the following:

"Comparative Tests for Crushed-Stone and Gravel Concrete in New Jersey." Preliminary discussion of the article, which appeared in the February, 1928, issue of Public Roads, was sent to member companies. Article and discussion later published in March, 1928, issue of National Sand and Gravel Bulletin.

List of Investigations to be Carried Out by the Research Laboratory.

"Talking Points for Gravel."

List of Filter Sand and Gravel Producers.

List of Concrete Structures in which Gravel Was Used as the Coarse Aggregate.

Report No. 1 on Investigations carried out in the Research Laboratory of the National Sand and Gravel Association, "Effect of Grading of Gravel on Its Unit Weight and Void Content." (Preliminary Report of Series 1.)

"Report on Merchandising Ready-Mixed Concrete."

As pointed out here, the preparation and dis-

TABLE 5. MISCELLANEOUS ARTICLES.

"Discussion of Bureau of Public Roads' Report on Comparative Tests of Crushed Stone and Gravel Concrete in New Jersey," by Stanton Walker.
National Sand and Gravel Bulletin, March, 1928.
Reprinted, Rock Products, March 31, 1928.
Reprinted, Pit and Quarry, March 28, 1928.
Summarized, CONCRETE, June, 1928.

"Sand for Use in Building Construction," by Stanton Walker and C. E. Proudley,
National Sand and Gravel Bulletin, April, 1928.
(Incorporated in Bulletin 3.)

"Requirements for Washed Gravel Ballast," by Stanton Walker and C. E. Proudley,
National Sand and Gravel Bulletin, May, 1928.
(Incorporated in Bulletin 3.)

"Tables of Quantities of Materials for Concrete," by Stanton Walker and C. E. Proudley,
National Sand and Gravel Bulletin, June, 1928.
(Published as Bulletin 4.)

"Sand and Gravel for Miscellaneous Uses," by Stanton Walker and C. E. Proudley,
National Sand and Gravel Bulletin, August, 1928.
(Incorporated in Bulletin 3.)

"Studies of Methods of Making Deval Abrasion Tests of Aggregates," by Stanton Walker,
1928 Proc. of Am. Soc. for Testing Mats., Pt. II.
Abstracted, Rock Products, July 7, 1928, under "A. S. T. M. Meeting Develops Important New Data."
Reprinted in Bulletin form.

"Cement Requirements for Some Concrete Mixes," by Stanton Walker.
CONCRETE, April, 1928.

"Sand and Gravel Research," by Stanton Walker.
Rock Products, December 22, 1928.

"Research Laboratory of the National Sand and Gravel Association," by Stanton Walker and C. E. Proudley.
Cement Mill and Quarry, January, 1929.

"Advances in Workmanship and Quality of Gravel Road Construction," by Stanton Walker,
Engineering News-Record, January 3, 1929.

tribution of information by publication or by special communication to members is one of our most important functions and it lends itself most readily to the equitable proportioning of our efforts among a widely distributed membership. This branch of our activities is among the first to suggest itself for expansion. The field for work is almost limitless. The same information can be put out in several different forms to reach different classes of readers. Additional information is available for preparation in the proper form. Distribution of the publication at regular intervals, instead of irregular intervals as opportunity permits, is highly desirable. A more careful building up of the mailing list should add to the value of our efforts along these lines.

For the coming year special attention is to be directed toward making the mailing list more valuable. Every effort will be made also to increase the number and regularity of publications, although completely satisfactory steps cannot be made in that direction until our means permit of a special staff to devote their entire time to this work.

Correspondence

Letter writing offers an efficient means of furnishing information on specific questions. Generally more detailed information can be given in a letter than in published material. Handling correspondence forms an important branch of our activities. Over 3,300 letters addressed to individuals have been written by this Division during the year. This includes no form letters. Of these, over 2,700 were in response to letters received from the outside. Correspondence relative to committee activities has accounted for a considerable portion of the work. Most of the letters, of course, dealt with routine matters, such as requests for literature, etc., but a great many of them made necessary the compilation of detailed information. It is not practical to outline in detail the many matters on which important letters have been written. They covered such subjects as relative merits of gravel and crushed stone, specifications and test methods, methods of proportioning concrete, effect of various impurities in sand and gravel, use of sand and gravel for special purposes and a large number of other subjects. A list of the more important letters, which is kept for ready reference for possible assistance in answering inquiries, includes about 75, showing an average of about one letter requiring considerably more than the average amount of work for every four days throughout the year.

Lectures

Talks and lectures before groups of engineers and sand and gravel producers offer a valuable means of promoting the interests of the established sand and gravel industry. Other activities have precluded the possibility of giving systematic attention to work of this kind. We have appeared only before those bodies which invited us on their own initiative. A great many more opportunities could have been had by indicating our willingness to appear. Among the meetings at which we appeared on the program should be mentioned the following:

Empire State Sand and Gravel Association,
Rochester, N. Y., January, 1928.
(1) "Requirements for Concrete Aggregates."
(2) "Work of National Sand and Gravel Association."

Annual Convention, Sand-Lime Brick Association,
Washington, D. C., January, 1928.
"Importance of Proper Requirements for Sand."

Meeting of Field Engineers of Tennessee Highway Department,
Nashville, Tenn., May, 1928.
"Relation of Aggregates to Concrete."

Ohio River Sand and Gravel Producers Association,
Huntington, W. Va., March, 1928.
"Work of the National Sand and Gravel Association."

Annual Convention American Society for Testing Materials,
Atlantic City, N. J., June, 1928.
"Studies of Methods of Making Deval Abrasion Tests of Aggregates."

Virginia Sand and Gravel Producers,
Richmond, Va., June, 1928.
"Activities of Engineering and Research Division."
Canada Sand and Gravel Association,
Toronto, Canada, July, 1928.
"Activities of Engineering and Research Division."
Empire State Sand and Gravel Association,
Rochester, N. Y., December, 1928.
(1) "Field for Research in Sand and Gravel."
(2) "Activities of Engineering and Research Division."

It is believed that in view of our limited personnel and our many other activities that the policy for next year with respect to lectures should be the same as for the past year; that is, accept invitations when it seems desirable, but not go very far in seeking opportunities.

Cooperation with Engineering Societies

Representing the sand and gravel industry in engineering societies and in committees concerned with specifications for sand and gravel constitutes a most important part of the work of the Division, but one for which it is most difficult to show evidence of tangible returns for our efforts.

Membership is held by the writer in the American Society of Civil Engineers, the American Society for Testing Materials, the American Concrete Institute, the American Society for Municipal Improvements, the American Railway Engineering Association, and in certain committees of the American Engineering Standards Association. Mr. Proudley is also a member of the American Society for Testing Materials.

Particular activity is maintained in the committee work of the American Society for Testing Materials, the American Concrete Institute and the American Railway Engineering Association.

In the American Society for Testing Materials our principal efforts are directed toward the work of Committee C-9 on Concrete and Concrete Aggregates, of which the writer is secretary. That committee, consisting of over sixty prominent engineers, takes the lead in developing information on and specifications for concrete and concrete aggregates. In addition to acting as secretary, the writer is a member of 6 of the 17 sub-committees.

In addition to Committee C-9, memberships are held in standing committees on "Road and Paving Materials," "Lime," and "Methods of Testing." Work was also done this year on a special committee formed to organize a Symposium on Mineral Aggregates for the next convention. Membership on any of these committees requires real activity and we have endeavored to contribute our share of the work. While the work consumes a considerable amount of time, it is considered as a very much worthwhile phase of our activities.

TABLE 6. LIST OF MORE IMPORTANT ARTICLES IN "OBSERVATIONS FROM THE ENGINEERING AND RESEARCH DIVISION," APPEARING MONTHLY IN THE NATIONAL SAND AND GRAVEL BULLETIN.

"Effect of Age on Strength of Concrete," February, 1928.
"Method of Test for Abrasion of Gravel," March, 1928.
"Workability of Gravel Concrete," April, 1928.
"Wear Tests of Concrete," May, 1928.
"Specifications for Concrete Aggregates," July, 1928.
"Importance of Mortar in Brick Masonry Construction," August, 1928.
"Round vs. Square Mesh Sieves," September, 1928.
"Effect of Grading of Gravel on Voids," October, 1928.
"Effect of Moisture in Test Specimens," November, 1928.
"New Wear Test for Concrete," November, 1928.
"The Effect of Temperature on the Tests of Concrete," December, 1928.

In the American Concrete Institute we are active in Committee E-3 on "Research" and Committee E-5 on "Agregates." In the American Railway Engineering Association membership is held in the Committee on "Ballast," our principal work being in connection with the sub-committee on "Washed Gravel Ballast." In the American Engineering Standards Association we are cooperating in the work of sub-committees on "Methods of Testing Road and Paving Materials," and on "Brick Masonry Materials."

The work in connection with the National Sand and Gravel Association's Committee on Standard Specifications also deserves mention at this point.

It would be of interest, undoubtedly, to outline in some detail our activities on these various committees, but time and space do not permit of it in this report.

Engineering Service to Member Companies

Direct engineering service to member companies offers an opportunity for Association service, the value of which is most readily assessed. Unfortunately, the wide distribution of the membership does not permit of an entirely equitable distribution of such activities. However, we have been able to respond to most of the calls on us for such service, and in practically all cases the results have been gratifying. This work has included a great deal of correspondence and a number of consultations, the latter having to do principally with discussions concerning interpretations of specifications.

Research Laboratory

Believing that the sand and gravel producer should take the lead in developing information concerning his product, the National Sand and Gravel Association has established a research laboratory dedicated to the discovery of truths concerning the products of the industry. While the principal activities of the Laboratory are being directed toward investigations of general interest to the industry,

its facilities are available to member companies for the solution of individual problems.

The Laboratory is in the basement of the Munsey Building in Washington, D. C., the building in which the headquarters of the Association are located. This is a particularly convenient arrangement, as it permits of supervision of the work with a minimum of interruptions to the general activities. The limited space available in a centrally located and popular office building has made it necessary, however, to economize in space for the Laboratory.

The Laboratory was first established in May, 1928. It is housed in three rooms—the main laboratory, an analytical room, and a constant temperature moist room for curing concrete and mortar specimens. The three rooms cover about 1,000 square feet and contain complete equipment to carry out the usual tests on sand, gravel and concrete.

The first investigation which was undertaken consisted of tests on the effect of grading of coarse aggregate on its void content. This investigation was considered of fundamental importance, since the void content of the coarse aggregate plays an important part in the economy of concrete mixtures—the amount of cement required being directly affected by the voids. The tests are also of importance in connection with investigations of the effect of grading of gravel on the compressive and flexural strength of concrete proposed for the future. The unit weights and the void contents have been determined for 57 different gradings of one gravel. The results of the tests were reviewed in the October 27, 1928, issue of Rock Products and some of the more important conclusions which could be drawn from the data were given briefly in the October issue of the National Sand and Gravel Bulletin. While it is expected that the tests already completed bring out the fundamental principles involved, the investigation will be repeated using other gravels and other types of aggregate.

The second investigation to be undertaken is along the same lines, except that sand and other fine aggregate are the subjects being studied. The tests have been completed on one sand and are being repeated on another. The information from the tests of fine aggregates will supplement that obtained from the first investigation.

The third investigation to be outlined attacks a problem which is of vital interest to every gravel producer. It involves a study of the effect of finer sizes, such as pea gravel, in the coarse aggregate. The results should be of great value in determining whether or not various specification limits on the amount of finer sizes are more rigid than necessary. Compression and transverse tests of concrete for a wide range of conditions are being carried out. About half of the specimens have been made and the first ones are now being tested. A report of the results will be made available as soon as the investigation is completed.

Work is being done in a study of washed gravel ballast in cooperation with the Ballast Committee of the American Railway Engineering Association. Efforts are being directed principally toward the development of methods of determining the hardness and durability of gravel for ballast. A number of samples have been collected and the results of the tests will be compared with records of service.

General studies are being conducted, as conditions permit, of sands exhibiting unusual characteristics when used in concrete or mortar. Tests have been carried out on a sand exhibiting feature not encountered before in a long experience of testing sands. The results of such tests must, in general, of course, be considered confidential, but it is expected that the information obtained from them will be of considerable general value.

The question of what amounts of soft, friable, flat and elongated pieces are harmful in gravel used for concrete is continually before specification writers. Studies on this question are now under way. The tests being carried out at this time deal particularly with the effect of flat particles. About 2 tons of gravel, separated into rounded and flat pieces, have been secured through the cooperation of a member company for this investigation.

A preliminary investigation of a method for determining the resistance of concrete to abrasion is under way. No standard method of making abrasion tests of concrete has been developed, and the methods proposed and used from time to time have generally required special apparatus not available in the average laboratory. With the establishment of the Research Laboratory of the National Association it was felt that equipment for such tests should be made available, but limited space and funds made it desirable to utilize standard equipment if possible.

The idea of using the standard Deval abrasion testing machine, common in most laboratories where stone and gravel is tested, was conceived. A few preliminary tests have been made with a view to establishing a tentative method of procedure. These consist of placing a 6-inch diameter cylinder of concrete in the Deval abrasion cylinder, the lid of which is raised slightly to permit the escape of detritus. Steel shot of "BB" size are used to create an abrasive action as the cylinder revolves.

Results thus far, using 6 by 12-inch cylinders of 1:2:4½ gravel concrete, show that an abrasive charge of about 3 pounds of shot produces the maximum abrasion. Further tests in which the

length of cylinder was varied showed a greater percentage loss for a 6 by 6-inch cylinder than for the longer specimens. The loss in weight at two, five and ten thousand revolutions indicated continuous abrasive action throughout the run.

Additional studies are being made of the proportions of the concrete mix, diameter of specimens, size of steel balls, and shape of concrete specimens best suited for the test, and, what is of greatest importance, the range of values obtained from various aggregates.

The preceding paragraphs have mentioned only problems on which work has been started in the Laboratory. These represent only a very small proportion of the subjects on which information is needed. They are quite wide in scope, however, and will require a considerable period of time before comprehensive information is obtained. These investigations and the future ones must be supplemented by observations of field conditions if the greatest value to the sand and gravel industry is to be realized.

The staff of the Engineering and Research Division feels a great deal of enthusiasm for the results which seem possible of attainment in the research laboratory. The many questions on which information is needed furnish a field of work which gives promise of being most interesting and profitable. It is proposed that the research laboratory be devoted to the solution of problems on which information is most needed. The space which has already been devoted to this report does not permit of more than brief mention of some of them. The many specification limits on extraneous materials in aggregates which have been based on the opinions of engineers and on local conditions, rather than on definite information, provide a large field of study and one for which the information should furnish immediate returns. Studies of the effect of grading of aggregate, on which satisfactory information has not as yet been obtained, should furnish most valuable results. Research, by its nature, requires considerable latitude in its execution and time must be allowed if authentic information is to be obtained. It is our object to obtain the maximum of useful information in the minimum of time, but the utmost care must be exercised to give sufficient time to each problem to obtain results which are comprehensive and accurate.

A feature of the laboratory which is of extreme value to the Association is the opportunity which it provides for bringing the work of the Association to the attention of the engineers and contractors. One of the best evidences of this are the many prominent engineers, sand and gravel producers, etc., who have visited the laboratory since its establishment. Within a period of four months fifty-six engineers, sand and gravel producers, contractors, etc., have inspected the laboratory. These have included men from all parts of the country and are representative of the class of people who play a large part in fixing the policies of engineers with reference to the use of sand and gravel.

Closure

The activities of the Engineering and Research Division, which have been outlined in this report, have been developed in an earnest effort to do the work of most value to the industry. Most of these activities do not permit of curtailment if the reputation of the Association as a source of information is to be maintained. As an example, the loose-leaf data sheets, which have recently been started, represent an addition to our duties which must be continued if their complete usefulness is to be realized. The most efficient distribution of our efforts is the ideal for which we should strive and it is hoped that every member of the Association will assist us by making a careful study of this report and suggesting to us methods by which we can make our efforts more effective.

The greater efficiency of the staff, which has come with training over a three-year period, should enable us to improve our opportunities and succeed in greater accomplishments during the coming year.

Report on Compensation Insurance for Marine Sand and Gravel Producers

On Friday, January 1, Chairman J. L. Richmond, of the Committee on Compensation Insurance for Marine Sand and Gravel Producers, made the following report:

At the Detroit convention of the National Sand and Gravel Association last year, a committee was appointed to study State compensation insurance laws affecting sand and gravel producers on inland waterways and to suggest ways and means of modifying State and Federal laws, which would eliminate the perplexities arising from present laws.

An article on this subject was published at considerable length in the January edition of the National Sand and Gravel Bulletin. The committee has given the matter considerable thought during the past year, consulting the Chief Counsel of the U. S. Employees' Compensation Commission, whose advice has been very helpful, and have had the matter up with compensation insurance commissions of several States.

The committee met as a whole at Chicago last June and discussed the subject from many angles and we make the following recommendations:

That the Association appoint committees in the various States where the producers are affected, to work through their State compensation insurance

commissions or agencies in charge of the administration of workmen's compensation laws of the State. If the commission is brought to see the advantage of such legislation to the employers in the State, they will probably draft an amendment that will fit in with the State law and either recommend it to the State legislature or make a favorable report on it when the matter is referred to them by the committee of the legislature having the bill in charge.

The present Federal law requires the U. S. Employees' Compensation Commission to recognize insurance either through an insurance policy or a State fund. Some of the States—namely California and New York—have modified their laws to extend the coverage of their State funds so as to place the funds in the same position as insurance companies so far as concerns coverage of liability under the Federal Longshoremen's Act. The insurance company can write a policy covering liability under the State workmen's compensation and, by an endorsement attached thereto, cover also the liability of the same employer under the Federal Longshoremen's Act.

When a State legislature authorizes its State fund to do so, it may also write the double coverage and thus be on an equality with the insurance company. Of course, in a State like Ohio having a monopolistic State fund to cover workmen's compensation and not allowing it to be covered by insurance policies, the only way for employers to cover their State and Federal liabilities in one operation is to have the State fund law amended so that it can cover also the Federal longshoremen's liability.

It is recommended that a circular of information be sent out to all members of the Association who are affected, discussing the results of our investigations and our recommendations; and that is that the State, longshoremen's, and maritime insurance all be worked out in the one State fund. It will not be difficult for our members to find out the status as to State coverage by insurance policy or State fund or both, or either exclusively. It should be possible to secure legislation for extending the State fund in practically all States having such funds, and this at the next session of the legislature.

With respect to whether the Federal Longshoremen's Act can be amended so as to bring within its provisions the crews of vessels operating upon the rivers and inland waterways, including the Great Lakes, it is of interest to note that the U. S. Employees' Compensation Commission has recommended to Congress in its annual report the inclusion of crews on fresh waters in the longshoremen's act and, possibly, also small craft in and around the harbors of salt waters.

We should try to get the members of the proper committee of Congress to introduce a bill for the purpose. Such an amendment to the longshoremen's act would be useful even though we would have no immediate success in amending the State fund laws of the several States, for it would then require only one insurance policy to cover the longshoremen's law liability without the additional policy to cover the admiralty and maritime liability on the crew.

Either Federal or State legislation along the lines suggested would be helpful, but the complete solution of our problem is an amendment of the longshoremen's law, so that the State fund, when amended, would cover not only the shore liability as it does now, but all other liability our members have. The payment of but one premium to the State fund would avoid much expense.

We should initiate immediately proposed State legislation so that our committee will be posted on how to proceed. We are preparing a circular with definite instructions as to what they are to do and how to do it. As a matter of information, we quote the modifications that have been made in California and New York laws to permit the coverage desired:

California

The Legislature of California amended the State Compensation Law May 17, 1927, Chapter 589, as follows:

> "Section 1. The workmen's compensation and safety act of 1917 as amended is hereby amended to add a new section thereto to be numbered section 36½ to read as follows:
>
> Sec. 36½. The State compensation insurance fund may insure California employers against liability for compensation under the United States longshoremen's and harbor workers' compensation act and any amendments which may from time to time be enacted thereto, as fully as any private insurance carrier."

New York

The New York Compensation law was amended in March, 1928, so that section 90 now reads as follows: (The new words embodied in this section are in italics.)

> "Section 90. Creation of State Fund. There is hereby created a fund to be known as "the state insurance fund" for the purpose of insuring employers against liability *for personal injuries or death sustained by their employees* and of assuring to the persons entitled thereto the compensation *and benefits* provided by this chapter *or by any act providing for compensation now or hereafter enacted by the Congress of the United States of America, if such liability is incident to an employment carried on in this state.*"

(*Continued on Page* 83)

Illinois Electric Limestone Company Operates Modern Crushed Stone Plant

By W. E. TRAUFFER,
Associate Editor, Pit and Quarry

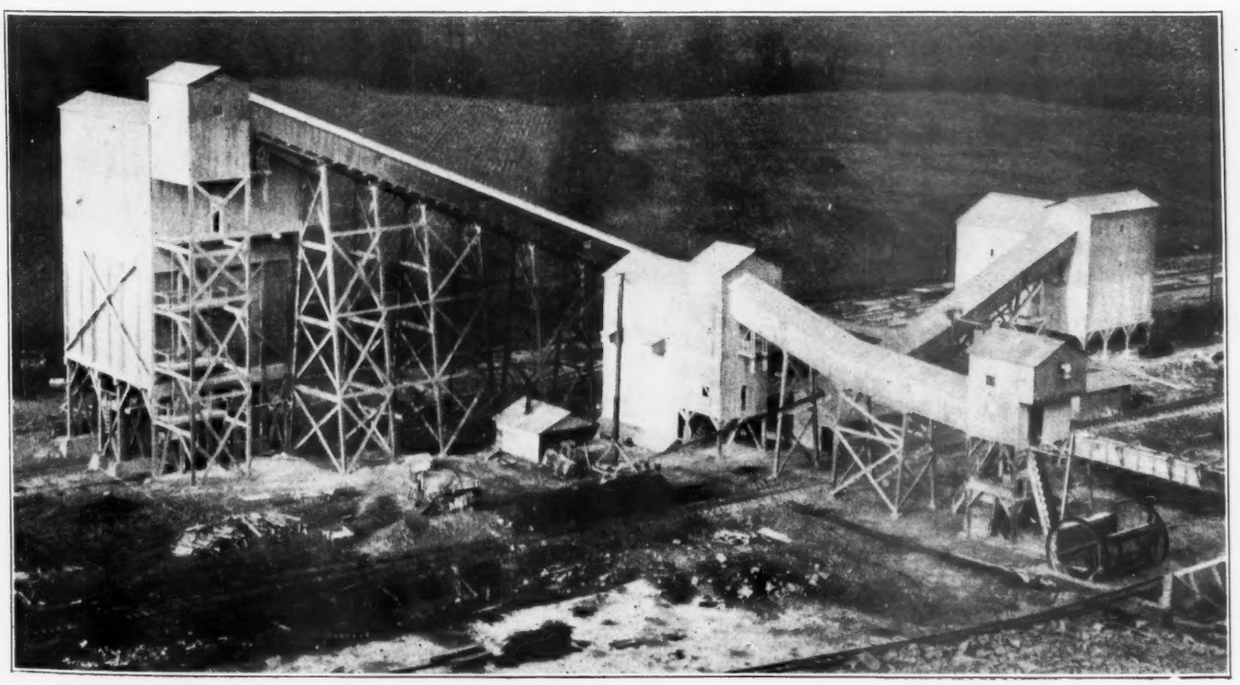
THE Illinois Electric Limestone Company operates a new plant at Falling Springs, Illinois, about 8 miles southeast of East St. Louis, which is a modern all-electric operation with the exception of a few steam driven units that are being replaced whenever possible. The new plant, when all of the equipment is installed, will have a capacity of 5,000 tons per day. The present daily capacity is about 2,500 tons.

The location is on the St. Louis Terminal railroad, which is owned by railroads entering St. Louis and which saves the producer the usual switching charges. The Kennedy-Van Saun Company of Danville, Pennsylvania, designed the plant. All building, crusher and other foundations, as well as conveyor tunnels, are of reinforced concrete. The buildings and conveyor housings have wood structural members and are covered with Toncan corrugated metal siding. Construction was started late in November, 1927, and the plant went into operation on March 1, 1928.

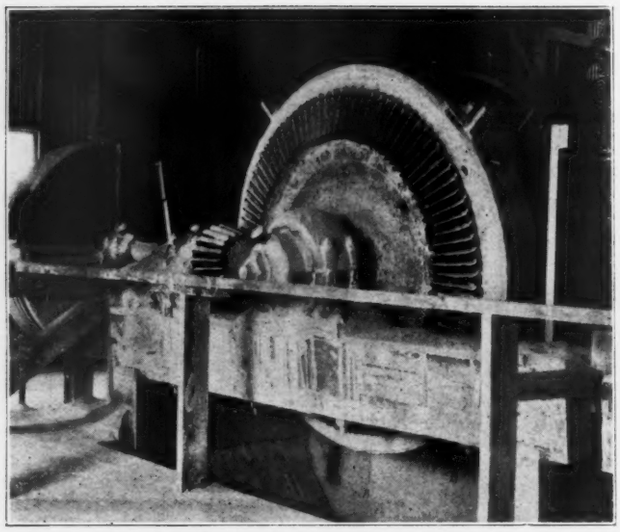
The overburden at the quarry varies from zero to 40 feet in depth and has been removed by a Bucyrus 18 B steam shovel. When operations are resumed in the spring this shovel will be replaced by a Marion Type 37 full revolving electric shovel with a 1¾ yard bucket which was recently purchased and has been used for loading loose stone in the quarry. The dirt is removed in dump cars hauled by a Whitcomb 13 ton gasoline locomotive to a dump at some distance from the quarry.

Shovel at the Face of Quarry

The bank method of blasting is used and blast holes are drilled by a Sanderson Cyclone electric well drill, with a 5⅝ in. bit, driven by an electric motor. Illinois 40 and 60 per cent dynamite is used. The face varies from 70 to 85 ft. in height and the blast holes are drilled 2 ft. below the floor of the



View of the Plant from the Southeast



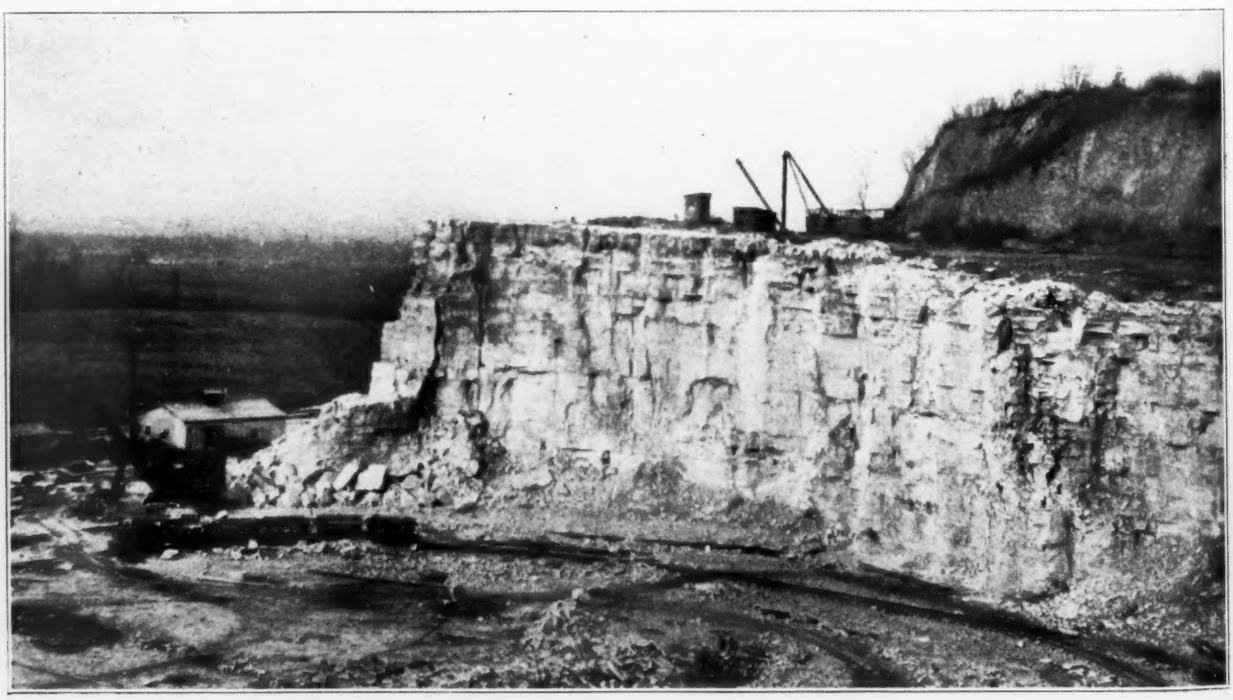
Enclosed Gear Drive for One of Secondary Screens

quarry. The stone is a very hard limestone and the formation is highly stratified. This helps to break up the stone and very little secondary blasting is necessary. Secondary drilling is done with two Ingersoll-Rand and one Chicago pneumatic jack-hammers.

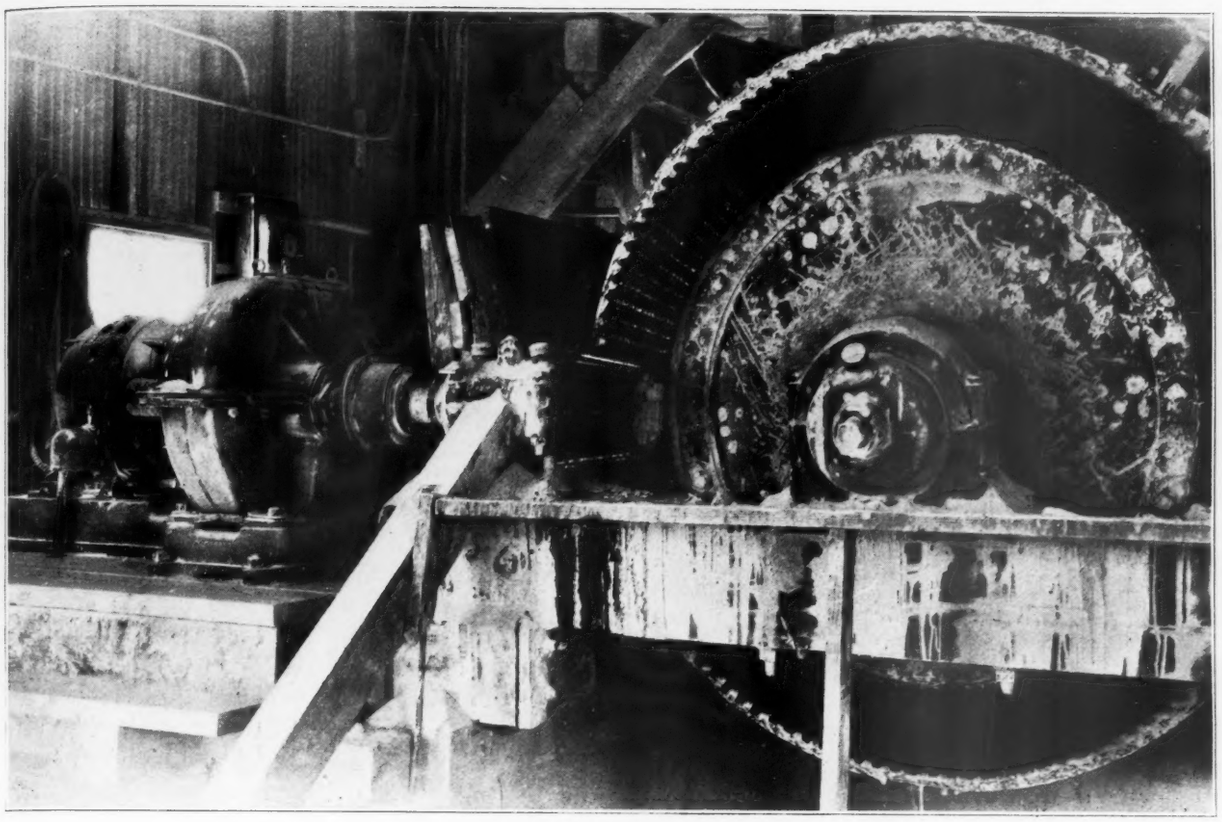
The stone is loaded by a Bucyrus railway type steam shovel, equipped with a 2½ yard dipper, into 5 yard Western side-dump cars. These cars are hauled by one 12 ton and two 8 ton Whitcomb gasoline locomotives on 36 inch gage track. The Marion 37 electric shovel previously described also assists in the loading. Another electric shovel, a Marion Type 490 full revolving caterpillar, with a 2¼ yard bucket, has been ordered and will be in operation next spring.

The cars are at present being dumped into the primary crusher by a Curtis air hoist. A rotary dump has been installed and will be used when the plant is brought up to capacity production. Twelve 30 ton all-steel cars operating on standard gage track will then be used. A 30 ton capacity hand operated hoist is supported on I-beams above the primary crusher and rotary car dumper. A hopper under the tracks feeds the stone into the Kennedy-Van Saun No. 36 gearless gyratory primary crusher driven by a direct connected 150 h.p. synchronous motor. The crusher is in a concrete pit dug into solid rock and discharges into a bucket elevator with 42 by 12 in. buckets, which elevates the material 70 feet. The elevator dumps into a hopper lined with rails which discharges onto a 48 in. inclined belt conveyor on 90 ft. centers, which conveys the material to the scalping screen. The elevator is driven through a Falk speed reducer by a 60 h.p. induction motor. The conveyor is driven at the head pulley by a 30 h.p. induction motor also through a Falk speed reducer, and has a vertical counterweight take-up.

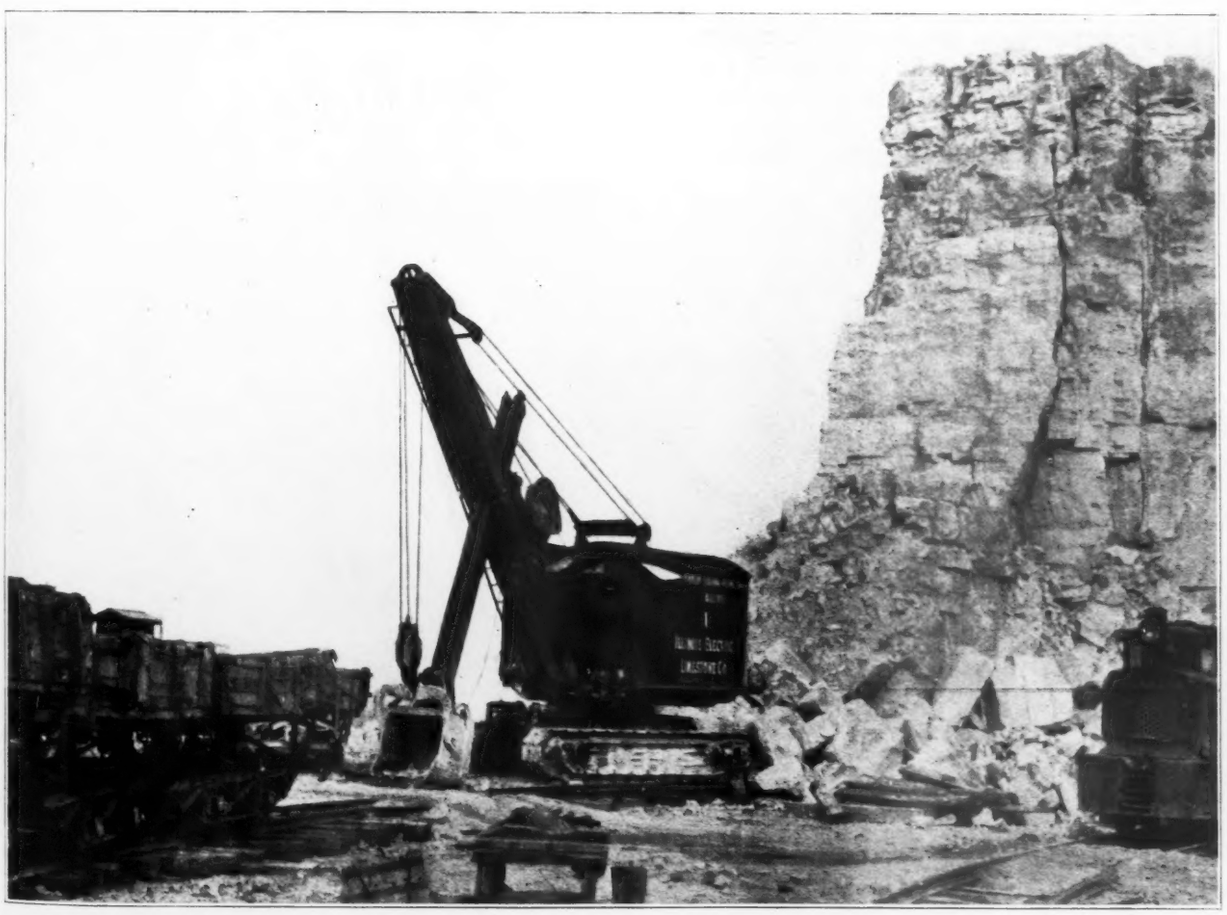
The conveyor discharges into a scalping screen located in the top of the secondary crusher building. This is a Kennedy-Van Saun 84 in. by 12 ft. revolving screen having three sections with 2½ in. perforations, and is driven by a 30 h.p. induction motor through a Falk speed reducer. The oversize falls to a small bin which feeds to either or both of two Kennedy-Van Saun No. 49 gyratory crushers in a concrete pit under the building. These crushers are direct driven by 75 h.p. synchronous motors. They discharge into a 36 in. inclined conveyor leading to the first screening building. The material passing through the scalping screen passes down a chute between the crushers to the same conveyor.



View of East End of Quarry, Showing Stripping Operations Above



Motor Driving Scalping Screen through Speed Reducer



New Shovel and Cars at the Quarry Face

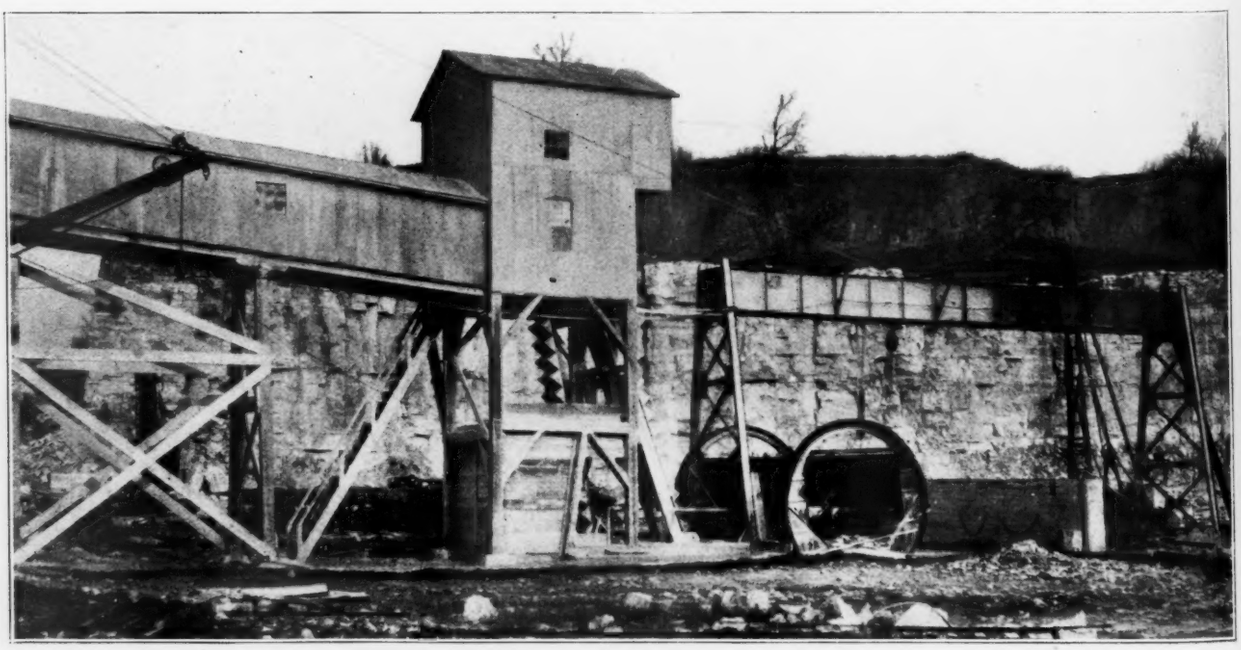
A Direct Driven Crusher

This conveyor operates on 211 ft. centers and has a vertical counterweight take-up. It is driven at the head pulley by a 50 h.p. induction motor through a Falk reducer. The material discharges into a divided hopper which feeds two Kennedy-Van Saun 72 in. by 18 ft. secondary screens with 2 in. perforations. These are each driven by 25 h.p. motors through direct gear drives. The oversize falls to a bin which feeds two Kennedy-Van Saun No. 37 gearless gyratory crushers direct driven by 50 h.p. synchronous motors. These discharge onto a 36 inch inclined belt conveyor leading to the top of the screening and storage building. The material passing through these screens is chuted directly to this same belt conveyor.

This conveyor operates on 350 ft. centers and is driven at its head pulley by a 100 h.p. induction motor through a Falk reducer. The same type of take-up is used as on the other two main conveyors. It discharges onto a 30 in. horizontal belt conveyor on 36 ft. centers direct driven by a 5 h.p. induction motor through a Falk speed reducer. This in turn discharges into a three-way hopper which feeds three 72 in. by 24 ft. Kennedy-Van Saun revolving finishing screens. Each of these screens is direct gear driven by a 25 h.p. induction motor. Two of the screens have 12 ft. of 1¾ in. and 12 ft. of 1¼ in. perforations, while the other has 12 ft. of 1¾ in. and 12 ft. of 1 in. Each screen has two woven wire dust jackets. The inner of these is 8 ft. long and the outer 6 ft. long. The five sizes of stone go direct to separate bins under the screens. These bins are of the louvred type and have a total capacity of 30 cars. They load through gates in the bottom of each bin into cars on either of two tracks under the bin. Switching is done by a Whitcomb gasoline locomotive.

Any surplus of screenings, most of which is sold as agricultural limestone, is loaded into Koppel dump cars and dumped on a stockpile. A small steam hoist at the bottom of the incline to the pile pulls the cars to the top by means of a snatch block arrangement. Later a conveyor system is to be installed for handling this material.

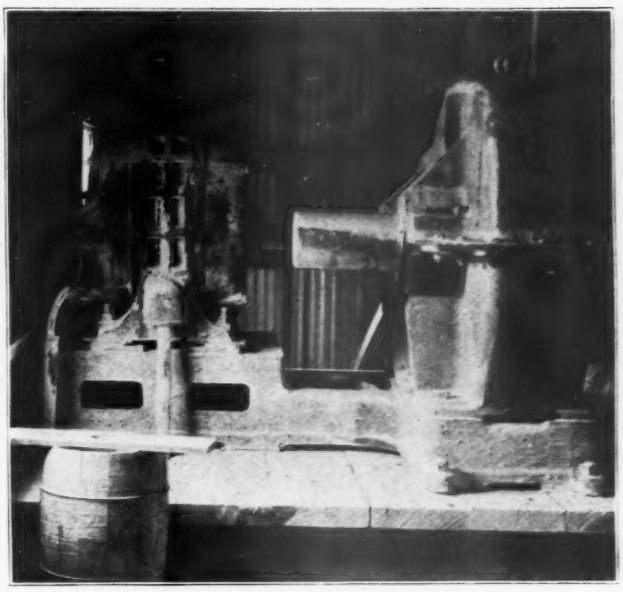
Power comes into the plant at 33,000 volts from



Rotary Dump to Primary Crusher with Elevator and Conveyor at Left

public service lines and is reduced to 2,300 volts at an outdoor transformer substation. Another transformer steps it down to 440 volts. Both of these are made by the General Electric Company. Water for the steam shovels and for other purposes comes from an open well, pumped by a Fairbanks-Morse steam pump operated by compressed air.

All conveyors between the various buildings are enclosed in housings of Toncan corrugated metal siding on wood frame. The main conveyor belts are all Thermoid brand and Falk herring-bone speed reducers are used throughout. All direct gear drives are completely enclosed in sheet metal housings. The Kennedy-Van Saun Manufacturing and Engineering Corporation of New York City furnished all elevators, conveyors, screens and crushers. With a few exceptions, all of the motors are Fairbanks-Morse ball bearing induction type. Starting equipment is all of the push button type. Fire-Gun hand fire extinguishers are distributed throughout the plant.



Motor and Speed Reducer for Driving One of Main Conveyors

The compressor building is located adjacent to the main buildings and also houses a motor generator set and switch-boards. A Gardner air compressor driven by a 40 h.p. Wagner electric motor furnishes air for the jackhammers and the air hoist used for car dumping. Another compressor is to be installed when the rotary car dumper is put into operation. An Electric Machinery Manufacturing Company motor generator set is used for excitation of the synchronous crusher motors. Each of the four plant units has its own switchboard panel and fuses in this building.

Provision has been made for enlarging the plant by the installation of extra screens and crushers. The foundations and pits of the secondary crushers are so designed that two more of each can easily be installed at any time. Provision has also been made for the installation of extra screens when they become necessary. The expansion program which is to be carried out during the winter and early springs includes, in addition to the electric shovel, the rotary dump and the steel dump cars: a dirt scalper, six additional gasoline locomotives, two more crushers, and a mile of track. A track scale is also to be installed and the foundation is already in place.

One of the Finishing Screens Showing Enclosed Gear Drive

Officers of the Illinois Electric Limestone Company are: John D. Moore, president; J. B. F. Melville, first vice-president; Robert Morrison, Jr., second vice-president; George M. Urquhart, secretary and treasurer; Ralph P. Jacoby, assistant secretary and treasurer; Fred C. Murphy, sales manager; Charles Figges, assistant sales manager. A. C. Dodd is superintendent of the Falling Springs plant, Walter LePere is master mechanic and Adolph Bilzing is quarry foreman. The executive offices are maintained in the new Telephone building in St. Louis.

Work of Committee C-9 on Concrete and Concrete Aggregates

Committee C-9 on Concrete and Concrete Aggregates of the American Society for Testing Materials is engaged in carrying out an unusually ambitious program of work for the coming year. The committee, which consists of over sixty prominent engineers, has had only one meeting since the close of its last year's work and, while no final reports have been made, specific objectives have been selected and definite recommendations should be forthcoming at the time of the spring meeting.

The personnel of the committee is divided into seventeen different sub-committees, to each of which is assigned several specific problems dealing with the various phases of concrete and concrete aggregates. Among the more important projects which are being considered by the committee, through its various sub-committees, may be mentioned the following:

Preparation of specifications covering mixing, conveying and placing of concrete.

Review of data on flexural strength of concrete with a view to determining if present methods of designing concrete mixtures for compressive strength can be applied to flexural strength.

Standardization of method of making transverse strength tests of concrete.

Development of apparatus for measuring workability of concrete.

Correlation of methods of making abrasion tests on stone, slag and gravel.

Determination of relation of shape of particle of aggregate to the cross-bending and compressive strength of concrete.

Determination of the suitability of stone and slag sand as a fine aggregate.

Study of effect of various extraneous materials, such as coal, lignite, alkali, shale, etc., on concrete with a view to fixing definite specification limits.

Studies of curing of concrete.

Studies of admixtures.

Recommendations for apparatus and methods of testing for determination of deformations in concrete.

Studies of factors affecting the durability of concrete.

Preparation of definitions of terms used in connection with concrete and concrete aggregates.

It is expected that the committee will have definite reports of progress on the projects listed above, as well as on several other important subjects, ready at the time of the next meeting, about March of the coming year.

Winter Building Going Ahead

Winter building plans are going forward at a rapid pace. The approach of cold weather no longer means a falling off of construction activity. The advantage of eliminating peaks and valleys in the building industry are chief reasons for the large volume of winter building of the last few years. The extensive use of limestone for a wide range of building types is evidenced by the fact that over 65 per cent of all finished building stone sold is limestone, nearly nine-tenths of which comes from the Bedford-Bloomington district.

Cut stone sales have surpassed any other year. Continued expansion of the giant facilities in the district makes it possible to promptly supply the needs of building contractors and all others who look to this district for their supplies.

With preparations all made for an active winter season, the outlook is bright for a steady growth and continuance of the large volume of construction well beyond the first of the year.

More than eight million cubic feet of limestone is stacked at the quarries of the Indiana Limestone Company to take care of winter needs. This is the greatest supply of Indiana limestone ever assembled by any one company or group of quarry operators in the entire history of the stone industry.

Southwest Road Show

The Fourth Annual Southwest Road Show and School, which will be held in the Exposition Building, Wichita, Kansas, February 26 to March 1, inclusive, is calling particular attention to the educational features during the Show. The exhibits at the booths and the improved road machinery will be of considerable interest to all who are sufficiently fortunate to attend this educational exposition. In addition, the discussions on road construction and maintenance, by the foremost engineers in the United States, will be of timely value.

The United States Bureau of Public Roads, the American Association of State Highway Officials, the Republic of Mexico, Oklahoma, Kansas, Nebraska, Colorado, Texas, Missouri, South Dakota and the Kansas State Agricultural College will again exhibit. The Show will be held under the auspices of the Wichita Thresher and Tractor Club.

Central Mixing Plants for the Manufacture and Sale of Ready Mixed Concrete

By NORMAN BEGGS
Structural and Technical Bureau
Portland Cement Association
Chicago

IN the last few years new control mixing plants for the manufacture and sale of ready mixed concrete have been established in all parts of the country. In 1925 the Portland Cement Association had a list of 25 existing plants. If a similar list were to be compiled today it would contain the names of nearly 100 concerns actually making and selling ready mixed concrete. This shows the recent growth of the industry, is an indication that this class of concrete is being favorably received in many localities and is a promise for the future. Although certain imperfections still remain in the manufacture and delivery of ready mixed concrete, the development that follows will tend to remove these difficulties and approach the ideal method of producing high quality concrete.

Due to the wide interest being shown in central concrete mixing plants, the National Sand and Gravel Association requested Mr. Norman Beggs, Structural and Technical Bureau Portland Cement Association to read a paper on this subject before their annual meeting in Cleveland, Ohio. The paper is the result of a study of central concrete mixing plants in the mid-western and eastern states. The Portland Cement Association is not promoting central mixing plants, but is glad to assist persons interested in such a business, by giving them the benefit of their experience in the problems of making concrete according to approved practices, and to assist them in any problems they may have to the accomplishment of this end.

Selection of Site for New Plant

The first consideration in establishing a central mixing plant is the selection of a suitable location. It should be chosen keeping in mind these three main points: (1) Proximity to the supply and transportation for bringing in concreting materials, (2) probable market for ready mixed concrete, and (3) nature and volume of vehicular traffic. The ground area should be of sufficient size to accommodate the mixing plant and to store a large quantity of materials. A well designed layout will eliminate the chance of a shutdown at a time when continuous operations are necessary.

Often a material dealer goes into the business of making and selling ready mixed concrete. He usually selects a part of the existing material yard as the plant site. This arrangement approaches the ideal, because it combines a supply of aggregates at all times with an established and going business and utilizes ground which ordinarily would be idle or at least not put to its maximum utility. A plant built either at the material yard or adjacent to it has an economic advantage as well as the assurance of a constant supply of aggregates. The superiority of a water front site should not be overlooked where economy afforded by using barges for bringing in materials is a factor.

Each plant layout presents an individual problem, the physical characteristics of the property determining to a large extent the general design. Provisions should be made for changes and expansion, so that later improvements may be made with a minimum of expense due to alterations.

Capacity of the Plant

Although difficult to determine, the probable demands on a new central mixing plant should be carefully estimated before construction plans are approved. For quantities up to 150 cubic yards of concrete per day, a 1-yard mixer will ordinarily take care of the work. Should a daily production of 250 to 300 cubic yards be desired, a mixer of 1½ yard capacity is advisable. Where plants are designed to handle up to 800 cubic yards of concrete a day, a 3-yard mixer should be used. With greater capacities it probably will be found desirable to install two 3-yard mixers and operate both of them rather than to plan on a single mixer of a larger size.

Most plant owners agree that the capacity of the mixer and the capacity of the truck for hauling should be the same. If a difference must exist, the mixer should be one-half or one-third the truck rating. Under those conditions a batch will be one-third, one-half, or a complete load, the latter being the most favorable arrangement. A minimum amount of time is needed for loading a truck when a single charging of the mixer makes an entire load of concrete. The batch may be started as the empty truck, returning from a job, approaches the plant. By the time the driver checks in, receives instructions for his next trip, has the truck washed and drives to the loading position the concrete is thoroughly mixed. His truck is entirely filled by a single batch and he starts for the job

Norman Beggs

immediately. There is no waiting for the second part of the load to be mixed such as is necessary if the mixer capacity is only one-half that of the truck. Most trucks are limited to not more than three yards of concrete, this restriction being placed by city ordinance, which provides a maximum load on the streets. The balance of the plant equipment should be designed to prevent tie-ups and delays on account of lack of materials. Any of the large machinery companies will furnish estimates and suggested layouts for plant design.

Building facilities, besides the mixing plant itself, should provide for a plant office, a warehouse for the storage of cement, a garage and a machine shop. It is desirable also to have space set aside for laboratory work where aggregates can be tested and concrete cylinders made and stored. Arrangements for the actual breaking of test cylinders can usually be made with some local laboratory equipped with a suitable testing machine.

Construction of Plant

The gravity type of central mixing plant is the most common form of construction. It is built with overhead storage bins for materials which discharge by gravity into weight batchers that in turn empty into the charging hopper of the mixer. The mixer, sufficiently elevated, dumps directly into the trucks. There may be certain variations in this plan, but most of the plants in existence are designed according to these principles. One large plant visited proportions materials by weight at one location, hauls those dry batches in flat bottom trucks a few hundred feet, and dumps them directly into the mixer hopper. Sacked cement is used here and is added at the time the dry batches are dumped. Another plant carries weighed amounts of sand, gravel and cement in a bucket conveyor, discharging them directly into the mixer. The purpose of this arrangement was to save head room because the equipment was installed in an existing building.

Aggregates are usually elevated to the bins either by belt or bucket conveyors. Sometimes a stiff-leg derrick or crane equipped with a clamshell bucket is used for this purpose. Advantage is always taken of any natural rise in the ground which may be made to assist in the elevation of materials.

If bulk cement is used, special building equipment is required. Mixing water is piped from the city supply to a measuring device, where the quantity may be accurately controlled. Electric power has been found extremely satisfactory and quite economical and is utilized for running the mixer and all other possible equipment. Cranes which travel under their own power are usually operated by steam.

Layout of Plant

A structural framework, preferably enclosed to protect the operators and equipment, supports the plant machinery at different elevations. The ground level is devoted to a driveway running either under or alongside the mixer. On the first floor above grade are the mixer and motor. Above this is the charging or operating floor, where the plant operator controls the proportioning of the materials and operates the entire plant. Over this are the storage bins. The height of the entire plant varies, ranging between 40 and 60 feet.

Paved driveways speed operations at the plant and are almost a necessity. Heavy trucks soon cut through cinders or other similar surfacing material.

Provisions for Cold Weather

Winter building has become so prevalent in the last few years that the control mixing plant should figure on a fair volume of business during the cold months.

Owners of central mixing plants have rapidly come to realize the value of delivering high quality concrete to the buyer, and that in cold weather the quality of the concrete is seriously affected if heating precautions are not taken. Temperature affects the rate at which concrete hardens, the lower temperatures reducing the rate until it practically

stops at the freezing point. Alternate freezing and thawing will completely destroy concrete, while a single freezing may impair the strength and durability. Because of these facts special precautions are required for cold weather work and should be employed when it is expected that the temperature will fall as low as 50° F. By supplying live steam to the aggregates through a perforated grillage of pipes lining the storage bins and using hot mixing water, warm concrete can be delivered to any job serviced. In transit open trucks should be covered with a tarpaulin to protect the concrete from the weather and to help conserve the heat. Even during the most severe weather only a small amount of heat is lost by radiation from the truck.

Common or rock salt or other admixtures should not be added to concrete to prevent freezing. When chemicals are used in quantities sufficient to lower the freezing point of water to any extent, they reduce the strength materially.

Bulk Cement

The question of the use of bulk cement is one which often arises at the time of construction. A number of plants have found it more economical than sacked cement. If protected from strong drafts there is a surprisingly small amount of dust created in handling bulk cement. The savings may be summarized as follows: (1) No labor required for cleaning, handling and shipping empty cement sacks, (2) no lost or damaged sacks, (3) less labor and quick unloading of cars, sometimes eliminating demurrage; (4) less money required to pay for a carload of cement, (5) no bookkeeping for sacks, (6) no fire insurance to pay on stored sacks, and (7) no storage space to provide for "empties."

One of the common methods of handling bulk cement is by use of an air conveying system, partly hydraulic and partly mechanical in action. It is essentially a tube containing a small screw conveyor fed at the front end by a hopper into which cement from the car is emptied, and equipped at the lower end with an aerated ring through which compressed air enters. Here is attached the conveying pipe, two to six inches in diameter, depending upon the required capacity. The screw, driven by a small motor, is directly connected to the shaft while the air is controlled by a separate compressor and valves. It is claimed by the manufacturers that the cement is "fluffed up" by the air, held in suspension, and forced through the pipe to the discharge end. At any rate, the volume of the cement is increased and made lighter by the addition of dry air. In this condition it assumes the properties of a fluid and is pushed, not blown, through the conveying pipe by the action of the screw on the incoming cement.

In the storage bin the aerated cement seeks an hydraulic level instead of heaping up under the discharge orifice. From the bin, cement may be drawn into the batcher in any desired quantity by means of a small screw conveyor.

Weight measurement is the only satisfactory method of proportioning loose cement because the volume may change as much as 50% to 100% due to varying amounts of air being included in the mass. Ninety-four pounds is accepted as a standard for one cubic foot of cement. At the mill, cement is sacked on this basis.

Truck Bodies

Hauling ready mixed concrete is the biggest problem of the plant owner. This is well illustrated by the fact that out of approximately 100 central mixing plants now operating, no standard type of truck body is in general use. The smaller plants employ the ordinary flat bottom dump trucks equipped with a vertical endgate or a hopper shaped end to help in dumping. The larger plants, for the most part, operate special trucks of which there are several on the market. Their function in hauling ready mixed concrete is to eliminate any segregation of materials that is apt to occur, to maintain a workable and plastic consistency without necessitating the addition of more mixing water at the job, and to facilitate dumping, making picking and shoveling unnecessary at the time of discharge.

Trucks used for hauling concrete may be classified into three groups:

(1) *Flat Bottom Type*—It is difficult to handle concrete having a slump greater than 3 to 4 inches for over a mile or two without causing segregation and compacting.

(2) *Special Body Type*—In this group are several designs, all of them planned either to partially eliminate segregation and compacting or to re-mix the concrete during discharge. Here, too, for successful service the concrete must be of a fairly dry consistency, and thoroughly mixed at the plant.

(3) *Agitator Type*—There are several designs of trucks to provide constant agitation in transit. Most of them are capable of handling concrete of any consistency, although in some a certain amount of difficulty is encountered in dumping the drier mixes.

Paving concrete, designed with a slump not to exceed two inches, can be delivered satisfactorily in almost any truck. When concrete of the consistency ordinarily used in reinforced work, with a slump of about six inches, is hauled any appreciable distance it is necessary to use some sort of agitation to prevent the separation of materials. When the agitator type of truck is employed the hauling distance is practically unlimited.

The length of haul, however, becomes an economic factor, for the cost of delivering ready mixed concrete increases with the distance the ma-

terial has to be transported. Experience will determine the limiting distances, and adjustments in the price of the concrete may be made accordingly.

Tests on Hauled Concrete

Specifications frequently include a limit between mixing and time of placing concrete. Ordinarily this is 30 to 45 minutes. On rare occasions it is placed at one hour. This limitation is intended to assure a good quality of concrete in the work. Therefore, instead of setting a definite time between mixing and placing of ready mixed concrete, the stress should be laid on the quality. Specifications should state that all concrete should be thoroughly mixed when delivered to the job and be in a plastic and workable condition without segregation. A time limit on the placing of concrete mixed at the site is not often a restriction, but with central mixing plants it may prove a serious hardship, especially in cities where the loaded trucks must pass through heavy traffic sections. The results of tests as indicated in "Public Roads" for December, 1921, and September, 1928, as well as other references, indicate that the quality of concrete is not impaired by hauls up to 25 miles in distance or three hours in duration, provided that the material is delivered in a workable condition and will not need additional water to facilitate its handling.

Washing of Trucks

Truck bodies should be washed after the delivery of each load. When the inside of the truck is clean and smooth, concrete will dump easier than if little or no attention is paid to keeping the body in this condition. An ordinary garden hose and city water pressure is usually sufficient. Oftentimes in washing truck bodies cement and fine material is carried into the drains, where it will harden and clog the sewers. To avoid this it is desirable to run the wash water through a sand filter. The installation of a box filled with sand two or three feet deep through which the water from the wash rack can pass before entering the city sewerage system will prevent trouble from this source. It is a comparatively easy matter to keep fresh sand in the filter, while on the other hand it is troublesome and expensive to clean the sewers after cement has hardened in them.

Quality of Concrete

The central mixing plant can be better equipped to produce quality concrete than can any other type of concreting plant. All the facilities necessary to handle economically every operation can be provided without feeling that the cost to one particular job is excessive. It should be the aim of the central mixing plant owner to advertise his plant as producing a quality concrete, and as being able to service any size job with a dependable product. The water-cement ratio as a basis for making concrete of predetermined strength and quality has been used on many important jobs during the last few years. Its use is continually increasing and more architects, engineers and contractors are requiring it for their work.

The central mixing plant operator should thoroughly understand the principles of making concrete under the water-cement ratio law.* This will afford him a practical means of making concrete of predetermined quality which he can use to discuss with builders the advantages of controlled concrete. In addition, he will have the opportunity of realizing definite savings in the amounts of materials comprising the mix.

The water-cement ratio law is stated as follows: "For given materials and conditions of manipulation, the strength of concrete is determined solely by the ratio of the volume of mixing water to the volume of cement so long as the mixture is plastic and workable."

The aggregate proportions are controlled by the desired workability. The amount of water required is stated in the specifications, and must not be changed. The plant operator will be at liberty, within reasonable limits, to adjust the proportion of fine to coarse aggregate, or to increase or reduce the total quantity of the aggregates, for with a constant ratio of water to cement, the quality is assured. In general, the central mixing plant operator will find it to his advantage to use the largest amount of aggregate consistent with proper workability.

Wider choice of aggregates is made possible by the use of a water-cement ratio specification. By proper adjustments of the mixture, aggregates of widely varying characteristics may be employed, under competent direction, to secure the desired strength and quality of concrete.

The mixing plant operator is given opportunity to use his experience and knowledge of concrete proportioning so he can design economical mixtures of excellent and uniform quality, adding to his reputation and lasting credit.

Cooperation and Service

The success of a ready mixed concrete plant is governed largely by its ability to fully cooperate with contractors. It is the problem of the plant owner, first, to have a sufficient number of trucks so there will be no serious delays at the plant due to the trucks all being out on the job, and second, to furnish concrete to the contractor at the time he wants it, causing him no inconvenience on account

*The Portland Cement Association, 33 West Grand Ave., Chicago, has published a booklet, "Design and Control of Concrete Mixtures," which should be in the hands of all those using cement for any purpose. This booklet will be furnished free on request.

of delays in deliveries. It is better to turn down certain contracts and keep the good will of those who are buying ready-mixed concrete than to try to service too many jobs in a single day. The establishment of good will betwen the central mixing plant and the contractor who is using the product is an important feature toward building up business and securing future orders.

Prices

Many operators find it advantageous to establish a definite schedule of prices for different classes of concrete. An established price, with small discounts for large quantities and prompt payment of invoices would seem to be the most satisfactory arrangement. A suggested schedule cannot be given because of the varying local markets. A price at the plant in one city for a certain class of concrete might change to twice that amount in another locality.

Hauling costs can be computed on the basis of established zones which each plant must work out for itself. For example, at one plant in a large city charges for transportation include a five-mile free haul with a 20-cent charge per yard mile for overhaul. In a medium sized city prices are quoted with a two-mile free haul and a 25-cent charge per yard mile for overhaul. In still another city one company operates on the basis of a fixed price at the plant and a 30-cent charge per yard mile. Where there is much rough pavement or many steep grades delivery zones cannot be based upon distance alone, but must also take in the physical layout of the community. A condition might exist that would make concrete cost more one-half a mile from the plant than it would at another site two miles away.

Capital Required

Capital required to start a central mixing plant depends on the type and size of plant and the trucking equipment. Small plants have been built for as little as $20,000 while others have started business on $40,000 to $50,000. One equipment company estimates that $100,000 is the necessary capital required to finance construction of a medium-sized plant. A large plant may represent an investment of as much as $450,000 or $500,000. It might be fair to state that transportation equipment for the medium and large-sized plants represents from 50% to 70% of the total cost. This cannot be set down as an invariable rule, but it does indicate the amount required for this division of the business.

Cost of Trucks

Due to the wide variety of trucks now used to haul concrete, prices vary from approximately $1,000 for the simplest type of small capacity to $8,000 or $9,000 for the heavier types of special design and greater capacity. One concern has 86 trucks operating, while another has 64. Several large plants use about this number to handle their business. Some of the smaller companies have only 4 or 5 of the light weight trucks to take care of their deliveries.

Operating Personnel

The number of men required to operate a central mixing plant differs according to the design of the plant. Usually there are a plant superintendent, a mixer man, a plant office man, a helper to load trucks, two or three men for handling cement, one or two laborers, and an operator for the derrick or hoisting equipment. Besides there are truck drivers, and if the plant owns a number of trucks, one or two garage mechanics. Sometimes a night watchman is employed.

Radius of Operation

The average radius of haul is another varying factor in connection with the operation of a central mixing plant. Some plant owners in the smaller cities find that three or four miles is the limit for deliveries; others deliver concrete on an average of 5 to 8 miles. Still others have transported concrete as far as 20 miles. Transportation costs then must be computed for each plant before an economical maximum haul can be established.

Sales

Many companies have special sales organizations to secure orders, while others depend upon friendly acquaintances with builders for business. One plant doing a fair business added a special salesman and in less than six weeks increased the average daily output from 200 to nearly 300 cubic yards. With a business as new as that of the central mixing plant, sales efforts should be well worth while both for producing immediate business and for advertising features in the use of ready mixed concrete which will result in future sales.

Truck Mixers

Because of the similarity to central mixing plants, mention should be made of central proportioning plants operating truck mixers. Some ready mixed concrete plants operate truck mixers in connection with their regular business. In general, approval has been placed on the ordinary stationary mixer, but questions have arisen as to whether or not truck mixers efficiently mix the concrete under all conditions of operation. As the driver must operate the truck as well as mix the concrete, the possibilities of accurate control are not as good as at a central plant.

The cost of truck mixers per yard of capacity is

greater than trucks used in the ready mixed concrete business. However, with truck mixed concrete the stationary mixer and its maintenance is eliminated. Which method of furnishing mixed concrete will have the greatest development is a matter that only time, coupled with future progress in the production of this class of concrete, can tell.

Conclusion

In conclusion, the points in favor of using ready mixed concrete are: (1) The responsibility for proportioning and mixing all concrete is placed in the hands of one man. This usually results in greater uniformity than is obtained in the field. (2) The permanency of the central plant allows the use of equipment to accurately measure quantities of materials that go into each batch, thus controlling the quality of concrete. (3) Mechanical equipment reduces labor costs to a greater extent than is possible under job methods. (4) The contractor is relieved of the necessity of setting up and maintaining a concreting plant. (5) Storage facilities for aggregates and cement, often difficult to provide in congested districts, are not required. (6) The hauling away of concreting equipment and excess materials after the completion of the job is eliminated.

With a favorable location, good equipment and careful operation there is every reason to believe that a central mixing plant will prove a success. The user of ready-mixed concrete is quick to realize its advantages. Where a high quality of product is produced, a fair price is charged, and an effort is made to give efficient service, there is every indication that the business will continue to grow.

Increase in Highway Traffic In Ontario

According to a report issued by the Ontario Government, traffic on the main roads of the province during the week of October 10 to 16, inclusive, was 20 per cent higher than a year ago. The daily average of all vehicles passing the 189 stations of the census takers of the Department of Highways was 31,242, as compared with 24,611 for the corresponding period last year. The maximum for one day was 53,874, as compared with 42,163 last year. Although fall census is taken at a time when the proportion of foreign cars is less than in the summer months, there was a daily average of 2,510 foreign cars, an increase of 26 per cent over 1927. The daily average of foreign cars last July was 7,515. The highest daily average, namely, 8,124, for a section of highway was recorded by the two stations of the Burlington Beach road. (Trade Commissioner Oliver B. North, Toronto.)

Millions Voted For Airports

By the popular voting of millions of dollars for airport construction, airports have been established as public utilities. Nearly $8,500,000 was voted for airports at the November 6 elections. Eleven cities or counties passed bond issue propositions ranging in amount from the $5,000,000 voted by Detroit to the $25,000 approved by the people of Albany, Oregon.

In a few localities the bond issue proposition for airports was defeated, but in most such instances the failure was due to circumstances which had nothing to do with the public attitude toward aviation. In Chicago, for example, where every bond issue presented by the present administration in the last two elections has been defeated, the item of $450,000 for development of the airport received the highest vote of all among the defeated projects.

During the last year appropriations or bond issues have been passed which involve more than $21,000,000, all of which is to be spent in supplying cities and counties with needed airport facilities.

Roads and Bridges in Wales

The question of an arterial ring road around Newport, which has been discussed for many years, has culminated in plans now before the Monmouthshire County Council. The steady growth of traffic has made such a road a necessity and it is pointed out that Newport will not suffer inasmuch as the traffic is "through traffic" and unremunerative to the city. At present all traffic to and from England is through Newport and the bridge across the River Usk at that place is the only approach. The proposed roads would start at a point on the Cardiff highway known as "The Straight," encircle the city of Newport and joint the Chepstow road at Danbeden. It would be an entirely new road, nine miles in length, through a picturesque section of the country. The construction of the road would employ 300 men for five years and mean £200,000 in wages to be circulated in the district. The estimated cost of the road is £300,000.

The Glamorgan County Council is budgeting for road improvements for the coming winter on a basis of £490,429. Part of this is to be used for uncompleted portions of previous schemes and the rest to straightening existing roads and the construction of a new viaduct to Abercynon. Members of the County Surveyors' Association have visited the new inter-valley roads of the Glamorgan County Council which are designed to link colliery valleys of the country. These roads involved a cost of between £400,000 and £500,000, of which the Ministry of Transport provided 75 per cent. The new mileage aggregates 37 miles. (Vice Consul Paul S. Sedicum, Cardiff.)

Policy of Vermont Marble Company Toward Its Employees

By F. A. WESTBROOK

A LARGE and successful industrial organization employing help by the thousand must of necessity have a well defined and enlightened policy with respect to its personnel. The nonmetallic mineral industries can be no exception to this basic rule of modern management. One of the best examples of this in the country is the Vermont Marble Company, which has a total of 3,500 employees on its payroll. With the idea of getting an idea of how this large and prosperous company handles the always delicate problem of personnel management, which is here so successful that labor troubles are practically unknown, an interview was recently had on the subject with Charles H. Tyrrell, whose official title is that of Safety Engineer. Some very interesting facts were thus brought to light.

Entire Families Work for Company

In Vermont alone, there are about 2,600 employees and at a special meeting held a year ago for those of long service, and still active, we find the following most remarkable figures: Seven had been in service over 50 years, one hundred had been with the Company between 25 and 50 years, three hundred between 15 and 25 years, and so on. There are numerous cases where fathers, sons and grandsons have been at work for the Company and many instances where a father and one or more sons and daughters, in clerical work, are now in its employ. This, of course, means a low labor turnover and provides at all times a good nucleus of "old timers" who know the business and are able to train in the newcomers—one of the most valuable assets any business can possibly have.

Unusual Years of Service

The most striking instance of a family of long service in the Company is that of the six Loso Brothers—Felix, Edward, Joseph, Chaplin, Napoleon and Antoine—who have a combined record of 245 years. Felix has been in the Company 44 years

Hospital at Proctor Where Plant Employes Receive Care

and started when he was 26 years old and works as a filler in the marble mill; Edward, who has had 47 years of service, began at the age of 21 as an errand and tool boy in the lathe shop, and for the past 40 years has been a chipper; Joseph began his labors 41 years ago at the age of 16 and has spent practically all his time sharpening drills and gauges; Chaplin, who has 34 years of service to his credit, started at 12 years of age as errand boy and now operates the same lathe that he learned his trade on; Napoleon started in 38 years ago at 13 and apprenticed himself in the cutting department where he is still employed; Antoine has now been in the employ of the Company for 35 years, starting at the age of 14 years in the polishing department where he is still operating a buffing machine.

Factors of Interest

While successful personnel management always largely depends on certain intangible and seemingly indefinable factors, such as the psychology of the executives, which communicates itself to those in the ranks in a sort of inarticulate way, the reasons for such success may be at least partially explained by certain visible policies which do take a tangible form. Thus the Vermont Marble Company has a pension system, by which provision is made for widows, no man with a family is ever laid off during good behavior, a great effort is made to provide good working conditions, safety work is pushed as strenuously as possible, and many other things are done looking toward the well-being of all.

Insurance and Pension System

It will be interesting to look into some of these matters in some detail. Let us begin with the pension system. This begins at the age of 65 years if a man has been employed for 20 years. It amounts to one per cent of the average pay of the last 10 years, multiplied by his total number of years of service. This rule, however, is flexible, for many men at 65 are still capable of doing a full day's work and there is no reason why they should be deprived of full pay or the Company of their services. Such men may, therefore, be kept on regular work, or work of a less strenuous character but still worth full pay, at the discretion of the Board of Directors. Furthermore, anybody who is pensioned is entirely free to get a job in some other place if he chooses, without its interfering with his pension, provided only that it is in some other line of work. In this way a man may take some easy work at low pay which, together with his pension, will net about his former income. The pension is also continued to his widow for a year after his death. From this it will be seen that the attitude of the management is most decidedly liberal and sympathetic, which cannot but be appreciated.

In addition to this, provision is made for the families of men who die young. Thus, the widow of any man who has been in the Company's employ for 3 years and who has not been pensioned, receives an income for 5 years, the amount of which depends on the man's length of service and his position.

Sutherland Club, a Recreational Center for Employes and Community

In cases of sickness, all those who are laid up over a week receive a weekly allowance from group insurance partly paid for by the Company and to which each contributes one dollar a month. A hospital is also maintained at Proctor, admittance to which Company employees have the preference and, it goes without saying, the rates are very low. The Company also retains physicians in the various towns where its mills and quarries are located, whom its employees may consult when they wish and who charge exceptionally low rates.

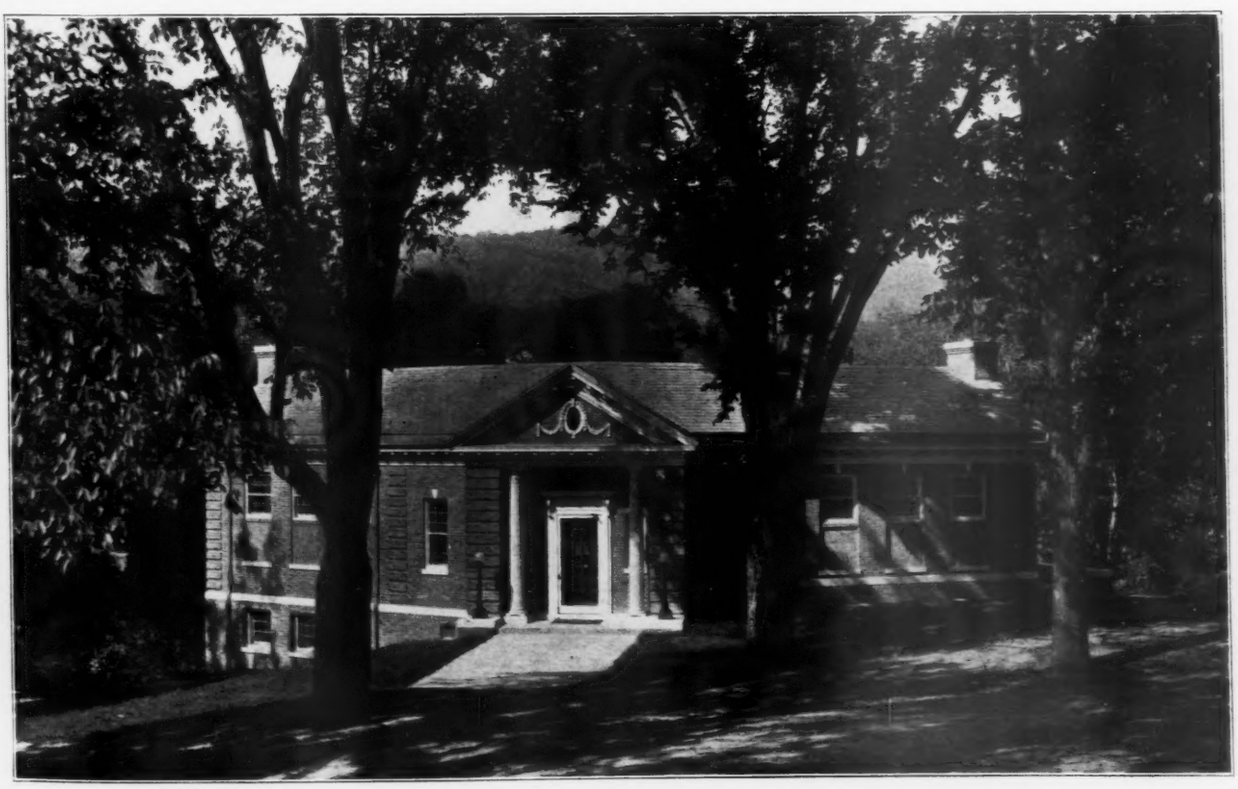
When it comes to accidents, of course, the compensation is determined by the state authorities, but such effective accident measures have been taken to prevent accidents that they have been reduced to a most remarkably low point, especially considering the heavy nature of the work. In the first place, all possible mechanical safeguards have been installed.

Safety Methods Employed

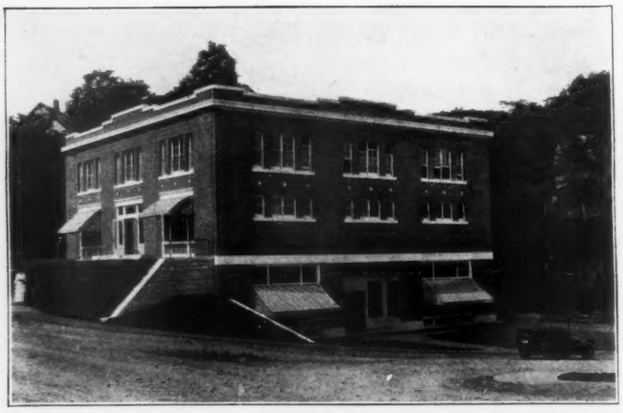
Every effort is made to educate the men to be safety-minded and Mr. Tyrrell has recognized that the first step in this direction is to begin with the foremen and make them realize that an important part of their function is to watch heir men and keep them from taking chances. In this connection, talks are given to groups of foremen by officers of the Company who try to inculcate the idea that production is not the only consideration, but that the avoidance of accidents is just as important. As Mr. Tyrrell says: "Some accidents cannot be avoided and some men cannot be educated," but at least no stone is left unturned. The bulletins furnished to members of the National Safety Council by that organization are posted in twenty different places and Mr. Tyrrell feels that they are noticed and helpful at least to the more careful men. He often sees the men looking at them, and even if only one important accident is averted it must be admitted by the most skeptical that they are worth while.

Safety committees have been organized in the various departments which make their reports or recommendations direct to Mr. Tyrrell. He then makes a personal inspection and sees to it that the dangerous condition is remedied. A book of safety rules in several different languages is also issued to all employees. One of the most practical and effective plans not only for saving life but for forcibly and graphically promulgating the idea of safety, is the compulsory instruction given on Company time on artificial respiration. Two hundred different men practice it in this way every month in groups in each department. The result is that almost everybody in the Company knows how to do it. Just this past summer one man was revived from apparent drowning and two from electrical shock. As all operations are completely electrified, it will be seen how important this is. In fact, every man in the electrical department has such practice each month.

The result of all these safety measures has been that last year there was only one fatality, and as that was due to the flood it could not be charged against the ordinary course of operations; and this year only one. Considering the character of the



Public Library, a Result of Vermont Marble Development



Cooperative Store in which Employes Share Profits

work, the record is most unusually good and must be a great source of satisfaction to all concerned.

Finally, a source of much good will among the employees is the fact that in times of industrial depression no one with dependents is laid off. If it is impossible to avoid laying off some of the help, the youngsters without responsibility are selected or are put on part time if any way can be found to do it.

Welfare Work and Care

Good working conditions in the way of good ventilation, adequate heating and so forth are of course provided and good houses are also furnished. There are no tenements and no dismal rows of houses identical in appearance in drab streets, such as are only too frequent in coal mining towns, for instance. There is also a library and a club, shown in the illustrations. The cooperative store returns all its profits to the employees who are its customers by dividing them in proportion to the amounts spent by each purchaser. In addition to this, there is an arrangement whereby the employees may save money by having a certain sum, in any amount in even dollars, taken from their weekly earnings and deposited to savings accounts in their names.

Suggestion Awards

Another plan which not only stimulates interest on the part of the employees, but also works to the benefit of the Company, is the system of cash awards given for helpful suggestions. The making of suggestions is encouraged to the greatest possible extent and the men are urged to make them. About one out of four is adopted and it has been found that sometimes an apparently simple suggestion proves of very great value. Very substantial awards are sometimes made; for instance, one of $400.00 was paid for a suggestion made in 1926. They range all the way down to $5.00.

Most of the labor is more or less skilled, much of it very highly skilled, so that measures of the kind described count for a great deal. Certainly, it must be said in this case that they have proved by experience they are effective.

Expansion and Contraction of Portland Cement Mortars

This investigation was instigated to ascertain the cause of crazing in mortars and stuccos and if possible to find a method or means of prevention.

Three sands screened between the 4 and 8 mesh, the 8 and 30 mesh, and the 30 and 100 mesh were used. These were mixed in varying proportions to obtain 10 graded sands of different surface areas. The mixes made of these 10 graded sands were in the proportions of one part of portland cement to three parts of sand. Each mix was applied upon three different bases, namely: an absorptive base, made of concrete, a non-absorptive rigid base of glass, and a non-absorptive, elastic base of rubber sheeting stretched over a glass plate.

These showed very little crazing as long as they were stored in the laboratory, but after a few months' exposure on the roof crazing developed on a number of the slabs. After a year and a half on the roof, nearly all of the slabs with the glass and rubber bases crazed, while the slabs on the concrete bases show crazing in only a comparatively few cases.

This seemed to show that controlled conditions of temperature and humidity were necessary, at least during the early hardening period of the mortar, to indicate which of the stuccos are distinctly better than others under the most severe conditions, such as high temperature and low humidity and under the most favorable conditions such as low temperatures and high humidity. Twenty-four inch by twenty-four inch by one inch slabs of 1:3 mortar were made on concrete bases in a constant temperature and humidity box. Half of the base of these slabs was wetted when the mortar was put on, and when the mortar had begun to harden, half was troweled smooth. This made four sections to each slab, namely, a dry base untroweled section, a wet base untroweled section, a dry base troweled section, and a wet base troweled section.

Duplicate slabs were made of each mix and one was stored in the laboratory, while the other was placed on the roof to weather. These mixes were made under the following controlled conditions of temperature and humidity:

1. 100 degrees F. and 40% to 50% humidity
2. 100 degrees F. and 75% to 90% humidity
3. 85 degrees F and 40% to 50% humidity
4. 85 degrees F. and 75% to 90% humidity
5. 70 degrees F. and 20% to 30% humidity
6. 70 degrees F. and 40% to 50% humidity
7. 70 degrees F. and 80% to 90% humidity

Inspections of the slabs on the roof and in the laboratory are carried out at regular intervals, but as yet no definite conclusions can be drawn.

1928 Was the Highest Year on Record In the Construction Industry

The 1928 construction volume was the highest in the history of the country, according to F. W. Dodge Corporation. Contracts let on new building and engineering work in the 37 states east of the Rocky Mountains during the past year reached a total of $6,628,286,100. This figure was 5 per cent ahead of the total for the year 1927 and it was 4 per cent in excess of the total for 1926. The previous high record had been held by 1926. The territory covered in the 37 Eastern States represents about 91 per cent of the country's total construction.

There was $432,756,300 worth of contracts let on new construction work during December. The above figure was 8 per cent below the total for November, 1928, and there was a drop of 9 per cent from the December, 1927, record. Analysis of last month's contract record showed the following important classes of work: $178,323,100, or 41 per cent of all construction, for residential buildings; $80,194,000, or 19 per cent, for public works and utilities; $66,772,600, or 16 per cent, for commercial buildings; and $38,247,900, or 9 per cent, for industrial projects.

Contemplated new work was reported in this territory to the amount of $725,170,800 during December. This figure shows a drop of 22 per cent from the amount reported during the preceding month and there was a loss of 27 per cent from the amount reported, during December, 1927.

New York State and Northern New Jersey

December construction contracts amounted to $138,340,700 in New York State and Northern New Jersey. Last month's total was 2 per cent ahead of the total for the preceding month and it was 7 per cent greater than the total for December, 1927. Analysis of the December building and engineering record showed the following items of importance: $64,429,900, or 47 per cent of all construction, for residential buildings; $24,470,500, or 18 per cent, for public works and utilities; $19,752,200, or 14 per cent, for commercial buildings; and $9,594,500, or 7 per cent, for educational projects.

During the year 1928 there was $1,814,316,800 worth of new contracts let on new building and engineering work in New York State and Northern New Jersey. When the above figure was compared with the total for the year 1927 there was an increase of 8 per cent.

Contemplated new work reported last month in this territory amounted to $195,026,200. There was a drop of 2 per cent from the amount reported in November, 1928, and there was a loss of 17 per cent from the amount reported in December, 1927.

New England States

The New England States had $28,222,900 in contracts for new construction work during the past month. The above figure showed a loss of 8 per cent from the total for November, 1928, and there was a loss of 9 per cent from the total for December, 1927. Included in last month's building record were the following important classes of work: $13,907,400, or 49 per cent of all construction, for residential buildings; $2,746,100, or 10 per cent, for commercial buildings; $2,453,000, or 9 per cent, for hospitals and institutions; $2,386,000, or 8 per cent, for educational projects; and $2,087,500, or 7 per cent, for public works and utilities.

The year 1928 closed with a total construction volume of $495,581,000, as compared with a total of $412,767,300 for the year 1927, the increase being 20 per cent.

The New England States reported $38,011,900 worth of new contemplated projects during the month of December. The above figure was 12 per cent ahead of the total for the preceding month, but there was a loss of 25 per cent from the total for December, 1927.

Middle Atlantic States

Building and engineering contracts were awarded last month to the amount of $51,962,100 in the Middle Atlantic States (Eastern Pennsylvania, Southern New Jersey, Maryland, Delaware, District of Columbia and Virginia.) The above figure was the highest December contract total ever recorded for this area. It was 14 per cent ahead of the December, 1927, record, but there was a decrease of 5 per cent from the total for November, 1928.

Last month's construction record included the following items of note: $19,605,700, or 38 per cent of the total, for residential buildings; $11,784,800, or 23 per cent, for commercial buildings; $7,066,700, or 14 per cent, for public works and utilities; $4,975,100, or 10 per cent, for industrial projects.

During the past year there was $787,672,800 worth of new construction work contracted for in the Middle Atlantic States, being a gain of 9 per cent over the amount contracted for during the year 1927.

New contemplated work reported last month in this district reached a total of $135,142,300. The figure was 22 per cent less than the total for November, 1928, and there was a drop of 2 per cent from the amount reported in December, 1927.

Pittsburgh District

December construction contracts let in the Pittsburgh District (Western Pennsylvania, West Virginia, Ohio and Kentucky) amounted to $39,093,800. This figure was 35 per cent under the total

for November of last year and there was an 8 per cent decrease from the December, 1927, total. Included in last month's building and engineering record were: $11,799,700, or 30 per cent, of all construction, for residential buildings; $10,451,200, or 27 per cent, for public works and utilities; $8,714,000, or 22 per cent, for industrial projects; and $3,490,100, or 9 per cent, for commercial buildings.

The December contract total brought the amount of construction started in the Pittsburgh District during the past year up to $723,415,700, which was a drop of 5 per cent from the total for the year 1927.

New contemplated projects as reported last month in this territory amounted to $41,666,500. There was a loss of 60 per cent from the amount reported in November, 1928, and there was a drop of 37 per cent from the total for December, 1927.

The Central West

The Central West (Illinois, Indiana, Iowa, Wisconsin, Southern Michigan, Missouri, Kansas, Oklahoma and Nebraska) had $120,459,500 in contracts for new building and engineering work during the past month. The above figure was 11 per cent below the total for the preceding month and there was a decrease of 27 per cent from the total for December, 1927. Analysis of the December contract total showed the following important classes of work: $55,526,500, or 46 per cent of all construction, for residential buildings; $20,468,000, or 17 per cent, for commercial buildings; $16,714,200, or 14 per cent, for public works and utilities; and $8,501,100, or 7 per cent, for industrial projects.

During the year 1928 there was $1,934,774,900 worth of contracts let on new construction in the Central West, as compared with $1,812,848,700 for the year 1927, the increase being 7 per cent.

New contemplated work reported in this area during the month of December reached a total of $216,185,400. This figure was 38 per cent under the total for the preceding month and it was 45 per cent less than the total for December, 1927.

The Northwest

During the past month the Northwest (Minnesota, the Dakotas and Northern Michigan) had $3,828,000 worth of new construction work started. The above figure was 34 per cent under the total for November, 1928, and it was 74 per cent less than the total for December, 1927. The following were the most important items in the December contract total: $1,170,800, or 31 per cent of all construction, for residential buildings; $856,500, or 22 per cent, for public works and utilities; $881,300, or 23 per cent, for educational projects; and $448,400, or 12 per cent, for commercial buildings.

Last month's building record brought the total amount of new construction started in the Northwest during the past year up to $80,190,700, being a loss of 4 per cent from the amount started during the year 1927.

New work reported as contemplated during December in this territory amounted to $9,136,300, being a gain of 13 per cent over the amount reported in the corresponding month of a year ago, but a loss of 16 per cent from November, 1928.

Southeastern States

December construction contracts in the Southeastern States (the Carolinas, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas and Louisiana) amounted to $33,895,900. This figure showed an increase of 14 per cent over the November, 1928, total, but there was a loss of 31 per cent from the December, 1927, record. Analysis of last month's building record showed the following items of note: $13,552,200, or 40 per cent of all construction, for public works and utilities; $8,290,700, or 24 per cent, for residential buildings; $5,662,500, or 17 per cent, for commercial buildings; and $2,937,200, or 9 per cent, for industrial projects.

New construction started in the Southeastern States in 1928 reached a total of $560,925,400, being a loss of 8 per cent from the amount started during the year 1927.

Contemplated new projects as reported last month in this district amounted to $57,373,500, which was a gain of 36 per cent over the amount reported in November, 1928, but a loss of 11 per cent from the amount reported in December, 1927.

Texas

The state of Texas had $16,953,400 in contracts for new building and engineering work during the month of December. This figure showed an increase of 28 per cent over the total for December, 1927, but there was a drop of 12 per cent from the total for November, 1928. Included in last month's building record were; $4,955,200, or 29 per cent, of all construction, for public works and utilities; $3,592,400, or 21 per cent, for residential buildings; $4,601,200, or 27 per cent, for industrial projects; and $2,420,500, or 14 per cent, for commercial buildings.

The December contract total brought the amount of new construction started in this state during the past year up to $231,408,800, being a gain of 6 per cent over the amount started during the year 1927.

New work reported in contemplation during the past month in Texas amounted to $32,636,700. This figure shows an increase of 70 per cent over the amount reported in the preceding month, but there was a loss of 9 per cent from the amount reported in December, 1927.

(*Continued from Page* 64)

It is further understood that the Workmen's Compensation Commission of Michigan permits state coverage.

We recommend that this matter be prosecuted vigorously and that all of the information be forwarded to our members at the earliest time possible. There is a lot of detail to be done in this insurance matter and we feel that the hearty cooperation of all of our members who are interested, that a great saving can be effected on our insurance premiums.

List of Exhibitors at Sand and Gravel Convention

Allen Cone Company

Exhibited operating model of sand cone, also photographs, bulletins and catalogs. E. S. Tompkins in attendance.

Allis Chalmers Manufacturing Company

Exhibited operating laboratory model of Superior crusher with Texrope drive and motor. Also a photo stand showing products of company, also bulletins and catalogs. G. W. Shores and A. Goldberg in attendance.

American Manganese Steel Company

Exhibited miniature operating model of Amsco centrifugal pump, also a 2½ in. Type I industrial pump and a miniature operating model of a dredge nozzle ladder with Amsco Chain fittings. A sample length of actual chain construction, a model Amsco "Missaba" steam shovel dipper and photographs of recent installations were included. A. L. Blakemore, A. W. Daniels, and Bradley S. Carr in attendance.

Barrymore Corporation

Photographs, circulars and catalogs displayed describing the Barrymore truck concrete mixer. Photographs showed details of construction and operation from the loading of the raw materials into the truck to the discharging of the mixed concrete at the job. C. H. Grant, in attendance.

Bennett, W. H. K., Company

Exhibited miniature working model of Diamond pump and agitator with dredge and raising and lowering mechanism. Manganese steel products of the Pettibone Mullihen Company were also displayed. Photographs and circulars completed the exhibit. W. H. K. Benett and O. W. Anderson in attendance.

Blaw Knox Company

Exhibited engineering data, photographs of installations of ready mixed concrete and washing, loading and batching plants. Also displayed a sectional model of ball-bearing lever arm sheaves for buckets. K. C. Brooks in atteandance.

Bucyrus-Erie Company

Exhibited working model of 120B electric shovel operated by controls taken from a full size shovel. F. O. Wyse, P. M. Richards and C. H. Mann in attendance.

Cement Mill & Quarry

Copies of recent issues on display. E. M. Buck and H. D. Hascoll in attendance.

Cemrock Incorporated

Displayed Cemrock building units which are made from oversupply of sand and No. 1 gravel. R. M. Byland and F. L. Ormesher in attendance.

Cincinnati Rubber Manufacturing Company

Exhibited samples of belting, suction hose, chute lining and dredge sleeves with photographs and literature. L. P. Dainell, J. W. Rude and C. M. Young in attendance.

Cross Engineering Company

Exhibited perforated metal screen plate with literature and photographs. W. S. Nicol in attendance.

Dorr Company

Exhibited miniature operating models of Dorrco bowl classifier and sand washer. Also photographs and literature. W. B. Gary in attendance.

Dravo Contracting Company

Showed motion pictures of dredge Kentucky in actual operation. Also displayed chute lined with Goodrich rubber and photographs, blue prints and literature of plant installations. V. V. Edwards, R. M. Coolidge and A. C. Leigh in attendance.

Eagle Iron Works

Exhibited working models of Eagle screen nozzle ladder and Eagle washer. Also photographs of installations. T. Aulmann, C. B. Laird, and H. F. Brown in attendance.

Fairbanks-Morse and Company

Displayed photographs and literature of Fairbanks-Morse equipment. G. J. Podlesak and F. M. Robie in attendance.

Fate-Root-Heath Company

Displayed photographs and literature. J. H. Neofie in attendance.

Federal Aid Highway System of the United States

Interesting exhibit of charts and maps showing mileage of Federal Aid highways in the United States by states.

General Electric Company

Exhibited and demonstrated photo-electric cell operation, Thyratron tube and high frequency effects. Also photographs of motors being used in the sand and gravel industry. L. W. Shicgg, J. Appleton and W. A. Gluesing in attendance.

Garst Manufacturing Company

Displayed full size drag scraper bucket and miniature model as well as photographs and literature. G. Garst and J. H. Hutchinson in attendance.

Good Roads Machinery Company

Displayed working models of 10-30 Champion roller bearing crusher and Champion sand wash box as well as a complete display of photographs and catalogs. J. W. Kitts, C. F. King, R. S. Scott and E. F. Phillips in attendance.

Harnischfeger Corporation

Exhibited model of P & H 600 shovel and showed motion pictures of units in operation. Also photographs and catalogs of complete P & H line. H. M. Davison, D. J. Murphy and H. S. Strouse in attendance.

Hayward Company

Model of derrick crane with miniature Hayward clamshell bucket. Also photographs and literature. H. C. Ryder and C. S. Sargent in attendance.

Hendrick Manufacturing Company

Displayed and operated full size sand and gravel testing screens for 25 to 100 lb. samples and line of perforated metal plate and double corrugated square mesh screen. B. G. Shotton and D. M. Blackburn in attendance.

Industrial Brownhoist Corporation

Displayed a three pulley standard Timken bearing troughing idler and a sectional roller showing construction. Also plans and photographs of installations. G. F. Climo and E. P. Sawhill in attendance.

Kensington Steel Company

Displayed sprocket with renewable teeth, dipper teeth, crusher jaws and cheek plates, pulverizer hammers, caterpillar links, sheave sheels, crusher concaves, drag chains, pulverizer rings and car wheels. E. C. Bauls and K. Jensen in attendance.

Koppel Industrial Car and Equipment Company

Displayed literature and photographs of products. D. F. Campbell and H. W. Redman in attendance.

A. Leschen and Sons Rope Company

Displayed samples of Red Strand wire rope with photographs and literature. D. E. Hickok and W. Berninger in attendance.

Link-Belt Company

Displayed miniature operating models of vibrating screen and Shaw classifier. Also a herringbone speed reducer, a belt conveyor idler and photographs of installations. C. S. Huntington, A. K. Schifflin, H. L. Strube and W. W. McKee in attendance.

Manganese Steel Forge Company

Displayed samples of all sizes of Rolman double lock mesh woven manganese steel screens from 6 mesh to 4 inch and a circular screen with rods welded forming continuous circle with no overlap. Also literature and catalogs. W. H. Potter and L. W. Jones in attendance.

Marion Steam Shovel Company

Exhibited test specimens of No. 830 cast steel and twisted and bent specimens. Also photographs and bulletins of various types of shovels. C. H. Gibbons and C. M. Howser in attendance.

Mead Morrison Manufacturing Company

Exhibited photographs and literature of products. P. S. Redfern in attendance.

Morris Machine Works

Displayed model pump with photographs and literature. F. S. Salchenberger and A. H. Young in attendance.

National Malleable and Steel Castings Company

Displayed Naco cast steel steam shovel chain in all sizes as well as Naco mine car wheels, hitchings, coupler and repair links. R. R. Roat, T. H. Doyle, and L. L. McKee in attendance.

New Jersey Wire Cloth Company

Displayed various kinds of iron and steel wire screens, also photographs and literature. G. Medinger, H. R. Kurtz, W. E. Foringer and F. Mesner in attendance.

National Safety Council

Displayed complete exhibit of safety campaign literature.

Niagara Concrete Mixer Company

Displayed and operated two No. 4 units of Niagara vibrating screens, the upper unit with 3 decks and the lower with two, and a No. 2½ two decks. All of these units were suspended, also photographs and catalogs. W. L. Wettlaufer, E. Wettlaufer, A. Owen, C. Hodges and J. Morrison in attendance.

Nordberg Manufacturing Company

Displayed laboratory model Symons cone crusher and literature. L. D. Hudson and D. Kay in attendance.

Osgood Company

Displayed literature and photographs of gasoline shovels, cranes, etc. E. C. Smith and J. A. McNeal in attendance.

Owen Bucket Company

Showed motion pictures of buckets in operation and display of photographs and literature. E. W. Botten in attendance.

Pit and Quarry

Display of recent issues, reprint and handbook. W. E. Trauffer and L. M. Weiss in attendannce.

Pittsburgh Coal Washer Company

Displayed and operated 4 by 10 foot double deck tandem vibrating screen and 3 by 5½ foot single deck vibrating scalping screen. Also chromite cast guide plated for abrasive materials and literature. E. R. Bollinger and C. R. Galloway in attendance.

Productive Equipment Corporation

Displayed and operated No. 12 laboratory size Jigger two deck vibrating screen. J. L. Westerhaven in attendance.

Rock Products

Displayed current issues. N. C. Rockwood, H. M. Fitch, R. C. Sullivan and W. A. Wilson in attendance.

Robins Conveying Belt Company

Displayed new style 203-Y D troughing idler, rubber cushioned idler Cataract grizzly and Gyrex screen. Also photographs and catalogs. L. M. Lambert, J. F. Meissner, S. D. Robins and S. Stadelman in attendance.

Sauerman Brothers

Displayed complete working model of sand and gravel plant with slackline cableway and drag scraper, hoists, bins, grizzly, and car bins. Motion pictures showed slackline cableway and drag scraper in operation.

Simplicity Engineering Company

Displayed and operated 3 by 6 foot three deck simplicity gyrating screen. Also had catalog of photographs and literature. G. W. Behnke, F. D. Barber, G. H. Cooper, R. C. Dunkel, J. B. Gower and O. B. Euler in attendance.

Smith Engineering Company

Displayed and operated models of Telsmith double eccentric balanced vibrating screen, sand settling tank and screew type rewasher, and Ajax revolving washing screen. Also photographs and literature. D. E. Barnes, V. H. Jones, J. R. Norton and G. Tower in attendance.

Stearns Conveyor Company

Displayed complete line of Rex Stearns Timken idler equipment and photographs of installations. G. M. Dyke, G. E. Mahoney, L. B. McKnight and R. A. Seidendtricker in attendance.

Stephens-Adamson Manufacturing Company

Displayed miniature operating models of S-A box car loader, live roll grizzly and Moore bin gate, as well as full size J. F. S. variable speed transmission, Simplex carrier and Style 455 carrier. C. H. Adamson, E. J. Patton, J. G. Stewart and J. L. Langner in attendance.

Taylor-Wharton Iron and Steel Company

Displayed wearing parts of caterpillar tractor, dredge chain links, bucket elevator chains, manganese steel woven wire screens, rotary pulverizer hammers and literature. J. A. Trainor, J. R. Smith and B. L. Bray in attendance.

Thew Shovel Company

Displayed catalogs and photographs of shovels. M. Garber, J. D. Seltzer and J. Beltz in attendance.

Tyler, W. S., Company

Displayed and operated full size Hummer vibrating screen and laboratory screens with electric shaker. Also showed various types of screen cloth with photographs and literature.

Una Welding and Bonding Company

Displayed dynamometer type Una welder and literature. W. J. Bushea in attendance.

Universal Crusher Company

Displayed and operated model gravel reduction crusher and displayed photographs and literature of complete line of crushers and hammer pulverizers. L. W. Dunlap and E. A. Velde in attendance.

Vulcan Iron Works

Displayed photographs, circulars and catalogs featuring gas-electric, diesel-electric and steam locomotives in all sizes from 3 to 75 tons. J. F. O'Brien and T. MacLachlan in attendance.

Welch, F. M., Engineering Service

Displayed plans and photographs of various sand and gravel plants designed. F. M. Welch in attendance.

Wheeling Mold and Foundry Company

Displayed 9 by 16 in. Hyatt roller bearing jaw crusher and plant photographs and literature. W. H. Sallwasser in attendance.

Williams, G. H., Company

Displayed working model of dragline bucket with photographs and literature. G. E. Swanson and C. F. Weiblin in attendance. New equipment costing around $65,000 is to be installed.

Among Those Present

Ahearn, V. P., National Sand & Gravel Association, Washington, D. C.
Adams, J. H., Sturm & Dillard Company, Circleville, Ohio.
Adamson, C. H., Stephens-Adamson Mfg. Co., Aurora, Ills.
Alexander, David, Petersburg Sand & Gravel Corp., Dixie Sand & Gravel Corp., Petersburg, Va.
Allen, John S., M. W. Allen Construction Co., Walpole, Mass.
Anderson, Oscar W., Ch. Eng., Pettibone Mulliken Co. (W. H. K. Bennett), Chicago, Ill.
Appleton, J. T., General Electric Co., Schenectady, N. Y.
Aukland, W. R., The Marion Steam Shovel Co., Marion, O.
Aulman, Theo., Eagle Iron Works, Des Moines, Ia.
Ault, C. M., The Barnes Sand & Gravel Co., Piketon, Ohio.
Avery, H. C., Niagara Con. Mixer Co., Buffalo, N. Y.
Aulenbacher, The Cleveland Builders, Cleveland, Ohio.
Adams, W. W., Bureau of Mines, Washington, D. C.
Ayres, A. O., Eau Claire Sand & Gravel Co., Eau Claire, Wisc.

Babcock, Merritt W., Indiana Gravel Co., Indianapolis, Ind.
Baker, Guy C., American Aggregate Corp, Greenville, Ohio.
Baker, Hugh P., Chamber of Commerce U. S. A., Washington, D. C.
Barber, F. D., Simplicity Engrg. Co., Durand, Mich.
Barnes, D. D., Smith Engineering Works, Milwaukee, Wis.
Bartholomae, W. F., Sauerman Bros., Inc., Chicago, Ill.
Battjes, N. H., Grand Rapids Gravel Co., Grand Rapids, Mich.
Bauer, E. C. & Jensen K., Kensington Steel Co., Chicago, Ill.
Battjes, Dewey F., Grand Rapids Gravel Co., Grand Rapids, Mich.
Battjes, Henry N., Grand Rapids Gravel Co., Grand Rapids, Mich.
Bebout, G. B., Muskingum River Gravel Co., Zanesville, Ohio.
Beck, Chas. L., Millville, N. J.
Beggs, Norman, Portland Cement Assn., Chicago, Ill.
Behnke, Geo. W., Simplicity Engineering Co., Durand, Mich.
Beltz, J. B., The Thew Shovel Co., Lorain, Ohio.
Bennett, Wm. H. K., W. H. K. Bennett Co., Chicago, Ill.
Bennett, Wm. A., Canada Gravel & Sand, Ltd., Toronto (Can.), Ont.
Beringer, Wm., A. Lescher & Sons Rope Co., St. Louis, Mo.
Binford, D. H., Delaware Sand & Gravel Co., Muncie, Ind.
Blackburn, D. M., Hendrick Mfg. Co., Carbondale, Pa.
Blakemore, A. L., American Manganese Steel Co., Chicago Heights, Ill.
Blanton, J. B., J. B. Blanton Co., Frankfort, Ky.
Blink, H. J., Northwestern Gravel Co., Lake View, Ia.
Bliss, W. A., Keystone Sand & Supply Co., Pittsburgh, Pa.
Bollinger, E. R., The Pittsburgh Coal Washer Co., Ambridge, Pa.
Botten, E. W., The Owen Bucket Co., Cleveland, Ohio.
Bowker, J. E., Birnie Sand & Gravel Co., N. Welbraham, Mass.
Boynton, E. W., Northern Gravel Co., Muscatine, Ia.
Bray, A. L., Taylor Wharton Iron & Steel Co., High Bridge, N. J.
Brooks, K. C., Blaw-Knox Co., Pittsburgh, Pa.
Brown, David A., John A. Roebling's Sons Co., Cleveland, Ohio.
Brown, H. F., Eagle Iron Works, Des Moines, Ia.
Buck, Edward M., Cement Mill & Quarry, New York City.
Buckbee, J. C., Northern Gravel Co., West Bend, Wis.
Bushea, W. J., Una Welding & Bonding Co., E. Cleveland, Ohio.
Byland, R. M., Cemroc, Inc., Cincinnati, Ohio.
Brown, Jess, Dixie Sand & Gravel Co., Chattanooga, Tenn.
Bird, Paul P., Boston Sand & Gravel Co., Boston, Mass.
Billeter, Frank J., Indiana Gravel Co., Indianapolis, Ind.
Burke, J. E., The Ready Mixed Concrete Co., Pittsburgh, Pa.; J. H. Davidson & Son, Pittsburgh, Pa.; Keystone Sand & Supply Co., Pittsburgh, Pa.
Bussche, von dun, C. F., Hydro Dredges, Inc., Detroit, Mich.

Caldwell, H. P., Ohio River Sand Co., Louisville, Ky.
Callahan, David G., The M. A. Callahan Co., Cleveland, Ohio.
Callahan, M. A., Cleveland Bldrs. Sup. & Brk. Co., Cleveland, Ohio.
Callahan, Norman F., The M. A. Callahan Co., Cleveland, Ohio.
Callahan, Nelson J,. The M. A. Callahan Co., Cleveland, Ohio.
Campbell, F. Dale, Koppel Industrial Car & Equip. Co., Koppel, Pa.
Carpenter, John G., Madison Sand & Gravel Corp., Hamilton, N. Y.
Carlin, W. M., Dravo Equipment Co., Pittsburgh, Pa.
Carr, Bradley S., American Manganese Steel Co., Chicago Hts., Ill.
Carroll, J. E., J. E. Carroll Sand Co., Buffalo, N. Y.
Carson, W. W., Jr., Texas Sand & Gravel Producers Assn., Austin, Tex.

Cheney, Geo. A., The Marion Steam Shovel Co., Marion, Ohio.
Clementz, Elmer E., A. J. Clementz Sons, Massillon, Ohio.
Coffman, Herbert, Hercules Cement Corp., Philadelphia, Pa.
Collins, R. C., Charles Warner Co., Philadelphia, Pa.
Cooley, C. G., Cooley Gravel Co., Gosport, Ind.
Coolidge, R. N., Dravo Contracting Co., Pittsburgh, Pa.
Cooper, Geo. H., Simplicity Eng. Co., Durand, Mich.
Cornnelle, Fred W., American Aggregate Corp., Cincinnati, Ohio.
Crisler, C. W., Potts-Moore Gravel Co., Waco, Tex.
Dalrymple, C. E., Raritan River Sand Co., New Brunswick, N. J.
Carlisle, W. C., The Toledo Vitrified Brick Co., Toledo, Ohio.
Coppock, F. D., American Aggregate Corp., Greenville, Ohio.
Conrades, Otto S., St. Louis Material & Supply Co., St. Louis, Mo.
Christie, L. R., L. R. Christie Co., Pittsburgh, Pa.
Collins, Rose, Spruce Pine Sand & Gravel Co., Spruce Pine, Ala.
Callahan, M. A., Graham & Henderson Co., Cleveland, Ohio.
Callahan, James J., M. A. Callahan Co., Cleveland, Ohio.
Chubb, J. H., Penn-Dixie Cement, New York, N. Y.
Conner, C. F., B. F. Goodrich Rubber Co., Akron, Ohio.
Darnell, L. P., Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
Davison, H. S., J. K. Davison & Bro., Pittsburgh, Pa.
DeHart, H. P., W. S. Tyler Co., Cleveland, Ohio.
Delp, R. S., Thew Shovel Co., Philadelphia, Pa.
Donnelly, Dan, Ohio Gravel Ballast Co., Cincinnati, Ohio.
DuBray, H. A., The Lake Shore Builders Supp. Co., Cleveland, Ohio.
Duff, Edward E., Jr., Engineering News Record & Construction Methods,-McGraw-Hill Pub. Co., Cleveland, Ohio.
Dunlap, L. W., Universal Crusher Co., Cedar Rapids, Ia.
Downs, B. A., Horne Ave. Sand & Gravel Co., Akron, Ohio.
Donahue, E. H., The Builders Sand Co., Cleveland, Ohio.
Downs, B. A., Horne Ave. Sand & Gravel Co., Akron, Ohio.
Davison, H. M., Harnischfeger Sales Corp., Milwaukee, Wisc.
Dugan, J. N., Cincinnati, Ohio.
Dunekel, Roy, Simplicity Engineering Co., Durand, Mich.
Daniels, A. W., American Manganese Steel Co., Chicago, Ill.
Dane, H. J., Hawkeye Material Co., Iowa City, Ia.
Dement, F. A., Sauerman Bros., Inc., Chicago, Ill.
Dann, Alex W., Keystone Sand & Supply Co., Pittsburgh, Pa.
Dillard, John L., The Sturm & Dillard Co., Columbus, Ohio.
Eberts, Harry W., Eberts Bros. Co., Wyandotte, Mich.
Eble, Clarence E., Cleveland Bldrs. & Supp. & Brk. Co., Cleveland, Ohio.
Engel, J. C., Raritan River Sand Co., New Brunswick, N. J.
Eberly, R. W., Buffalo Gravel Co., Buffalo, N. Y.
Ellis, H. C., Ohio & Michigan Sand & Gravel Co., Toledo, Ohio.
Euler, O. B., Simplicity Engrg. Co., Durand, Mich.
Ely, Orra, American Aggregate Corp., Massillon, Ohio.
Edwards, V. B., The Dravo Contracting Co., Pittsburgh, Pa.
Ellen, Grant, The W. S. Tyler Co., Cleveland, Ohio.
Evans, J. H., The Sturm & Dillard Co., Columbus, Ohio.
Fairbank, C. R., Birnie Sand & Gravel Co., N. Welbraham, Mass.
Faus, Stanley J., Stanley J. Faus, Royal Oak, Mich.
Featherstonhaugh, A. C., Blaw-Knox Co., Pittsburgh, Pa.
Ferguson, Earl L., Milwaukee Assn. of Commerce, Milwaukee, Wisc.
Fisher, W. W., Central Sand & Gravel Co., Memphis, Tenn.
Fitch, H. M., Rock Products Magazine, Chicago, Ill.
Fletcher, R. C., Flint Crushed Gravel Co., Des Moines, Ia.
Foringer, W. E., New Jersey Wire Cloth Co., Trenton, N. J.
Foster, Alexander, Jr., Chas. Warner Co., Philadelphia, Pa.
Foster, L. E., The Marion Steam Shovel Co., Marion, Ohio.
Fritz, Arthur J., A. J. Clementz & Sons, Massillon, Ohio.
Frosch, A. E., East Liverpool Sand Co., East Liverpool, Ohio.
French, J. C., Monighan Mfg. Co., Chicago, Ill.
Frame, R. S., Jr., American Aggregate Corp., Greenville, Ohio.
Galloway, C. R., Pittsburgh Coal Washer Co., Ambridge, Pa.
Garber, M. B., The Thew Shovel Co., Lorain, Ohio.
Garrett, R. E., Charlestown Sand & Stone Corp., Elkton, Ind.
Garst, G., Garst Mfg. Co., Chicago, Ill.
Gery, W. B., The Dorr Co., New York City.
Gibbons, C. A., The Marion Steam Shovel Co., Marion, Ohio.
Glander, C. E., American Aggregates Corp., Greenville, Ohio.
Goldberg, Abe, Allis-Chalmers Mfg. Co., Milwaukee, Wisc.
Gower, J. B., Simplicity Eng. Co., Durand, Mich.
Grant, C. H., Barrymore Corporation, Cleveland, Ohio.
Greeley, P. J., The Builders Sand Co., Cleveland, Ohio.
Grant, F. H., American Aggregate Corp., Detroit, Mich.
Haddow, Hugh, Jr., Menantico Sand & Gravel Co., Millville, N. J.
Haggerty, A. J., General Concrete Products Corp, Warren, Pa.
Hahn, Robert H., Hahn Bros. Sand & Gravel Co., Muscatine, Ia.
Hahn, Walter R., Hahn Bros. Sand & Gravel Co., Muscatine, Ia.
Hall, D. P., The T. J. Hall Co., Cincinnati, Ohio.
Hall, R. F., West Baden, Ind.
Hall, Fred E., The T. J. Hall Co., Cincinnati, Ohio.
Harris, C. H., Massillon Washed Gravel Co., Navarre, Ohio.
Harris, W. G., Rubber City S. & G. Co., Akron, Ohio.
Hascall, H. D., Cement Mill & Quarry, New York City.
Herget, W. F., Rock Island Sand & Gravel, Rock Island, Ill.
Hickok, E. E., A. Leschen & Sons Rope Co., St. Louis, Mo.
Himmlear, W. C., National Association, Washington, D. C.
Hodge, S. C., Niagara Concrete Mixer, New York, N. Y.
Huber, E. T., The Marion Steam Shovel Co., Marion, Ohio.
Hudson, L. D., Nordberg Mfg. Co., Milwaukee, Wis.
Huntington, C. S., Link-Belt Co., Chicago, Ill.
Hutchinson, J. H., Garst Mfg. Co., Chicago, Ill.
Heaman, J. A., Grand Trunk R. R., Detroit, Mich.
Harman, J. W., Ohio Valley Sand Co., New Martinsville, W. Va.
Hendy, Michael, Miss. River Sand & Mat. Co., St. Louis, Mo.
House, Geo., New Jersey Sand & Gravel Co., Asbury Park, N. J.
Hutchins, Chas. O., Wyoming Sandy Stone Co., Wilkes Barre, Pa.
Hammond, E. M., Ward Sand & Gravel Co., Oxford, Mich.
Hamm, Rollie, Indiana Gravel Co., Indianapolis, Ind.
Hopkins, Richard, Contractor, Troy, N. Y.
Irvine, J. E., Green River Sand Pit, Green River, Wyo.
Irving, Ralph, Irving Bros. Sand & Gravel Co., Ft. Wayne, Ind.
Irving, F. W., Irving Bros. Sand & Gravel Co., Ft. Wayne, Ind.
Irving, Ray J., Irving Bros. Sand & Gravel Co., Ft. Wayne, Ind.
Jahncke, W. Chas., Jahncke Servis, Inc., New Orleans, La.
Jensen, J. K., Janesville Sand & Gravel Co., Janesville, Wis.
Jones, L. W., Manganese Steel Forge Co., Philadelphia, Pa.
Jones, Victor H., Smith Engineering Works, Milwaukee, Wisc.
Jones, Rowland, Keystone Sand & Supply Co., Pittsburgh, Pa.

Jordan, W. H. Columbia Sand & Gravel Co., Washington, D. C.
Jordan, A. L., W. S. Tyler Co., Cleveland, Ohio.
Jacobs, L. E., Rubber City Sand & Gravel Co., Akron, Ohio.
Jackus, J. H., Rock Island Sand & Gravel Co., Rock Island, Ill.
Kay, Delbert, Mordberg Mfg. Co., Milwaukee, Wisc.
Kennedy, John W., Huron Portland Cement Co., Detroit, Mich.
Kerr, Geo. W., Ohio State Div. of Highways, Columbus, Ohio.
Keveney, R. D., Northern Gravel Co., West Bend, Wisc.
Keyes, S. S., A. & K. Builders Supplies, Inc., Jamestown, N. Y.
King, M. A., Good Roads Machinery Co., Kennett Square, Pa.
Kinnance, W. D., Hetherington & Berner, Indianapolis, Ind.
Kitts, J. W., The Good Roads Mach. Co., Inc., Kennett Square, Pa.
Knight, Hal G., The Rubber City Sand & Gravel Co., Akron, Ohio.
Knehme, Otto, Jr., Kansas Sand Co., Topeka, Kans.
Kurtz, Harold R., The New Jersey Wire Cloth Co., Trenton, N. J.
Kaufman, V., W. S. Tyler Co., Cleveland, Ohio.
Kaufman, H. J., The Arrow Sand & Gravel Co., Columbus, Ohio.
Laird, C. B., Eagle Iron Works, Des Moines, Ia.
Lambert, M. S., Robins Conveying Belt Co., Chicago, Ill.
Lange, Harry P., Queen City Sand & Gravel Co., Cincinnati, Ohio.
Leigh, R. C., Dravo Contracting Co., Pittsburgh, Pa.
Logsdon, R. E., Chamber of Commerce, Memphis, Tenn.
Long, R. E., Cooley Gravel Co., Gosport, Ind.
Lotz, Oscar, Carl Lotz Sand & Gravel Co., Wausau, Wis.
Lysle, F. B., West Penn Cement Co., Butler, Pa.
McIntyre, Blaw-Knox Co., Pittsburgh, Pa.
McKee, L. L., Nat. Mall. & Steel Castings Co., Cleveland, Ohio.
McKee, W. W., Link-Belt Co., Philadelphia, Pa.
MacLachlan, Thomas, Vulcan Iron Works, New York City.
Mallock, Douglas.
Martin, Paul R., Davenport Locomotive & Mfg. Corp., Davenport, Ia.
Mason, Joseph, Joseph Mason Smelting Co., Toronto, Can.
Medinger, George, New Jersey Wire Cloth Co., Trenton, N. J.
Mortense, L. T., Utah Sand & Gravel Co., Salt Lake City, Utah.
Moore, J. J., The Day & Maddock Co., Cleveland, Ohio.
Mullen, C. F., The Georgia Gravel Co., Columbus, Ga.
Murphy, D. J., Harnischfeger Sales Corp.
Mesner, Wm. F., The New Jersey Wire Cloth Co., Trenton, N. J.
McGaw, Joseph R., Mineral Products Co., Pittsburgh, Pa.
McHugh, John T., Lakewood, Ohio.
Marsters, J. L., Arrow Sand Gravel Co., Columbus, Ohio.
Milkowski, Victor J., Morris Machine Works, Baldwinsville, N. Y.
McGowan, Wayne A., Ideal Sand & Gravel Co., Mason City, Ia.
Mann, C. H., Bucyrus Erie Co., S. Milwaukee, Wisc.
McNeal, J. A., Osgood Co., Marion, Ohio.
Merwin, J. K., Stearns Conveyor Co., Cleveland, Ohio.
Miller, M. D., Railroad Water & Coal Co., Chicago, Ill.
Moran, John D., Central Sand & Gravel Co., Memphis, Tenn.
Newman, David W., New Jersey Sand & Gravel Co., Asbury Park, N. J.
Nicol, W. S., Cross Engineering Co., Carbondale, Pa.
Newey, J. W., American Aggregate Corp., Chicago, Ill.
Neofie, John H., Fate Root Heath Co., Plymouth, Ohio.
Norton, J. R., Smith Engineering Works, New York, N. Y.
Nicoll, N. B., Norman B. Nicoll, Detroit, Mich.

O'Brien, J. F., Vulcan Iron Works, Wilkes Barre, Pa.
Onnesher, F. L., Cemroc, Inc., Cincinnati, Ohio.
Owen, A. E., Niagara Concrete Mixer Co., Buffalo, N. Y.
Owens, H. V., Boonville Sand Corp., Utica, N. Y.
Orr, R. H., Rubber City Sand & Gravel Co., E. Akron, Ohio.

Patton, E. J., Stephens-Adamson Mfg. Co., Aurora, Ill.
Peck, F. W., Peck-Thompson Sand Co., Kansas City, Mo.
Peirson, H. F., W. S. Tyler Co., Cleveland, Ohio.
Piggott, Wallace J., W. S. Tyler Co., Cleveland, Ohio.
Podlesak, G. J., Fairbanks, Morse & Co., Chicago, Ill.
Poland, J. F., Industrial Brownhoist Corp., Cleveland, Ohio.
Potts, Robt. J., Potts Moore Gravel Co., Waco, Texas.
Potter, W. H., Manganese Steel Forge Co., Philadelphia, Pa.
Prince, John, Stewart Sand & Mat. Co., Kansas City, Mo.
Proudley, C. E., National Sand & Gravel Co., Washington, D. C.
Purdum, C. H., The Sturm & Dillard Co., Syracuse, Ind.
Protte, Albert J., Miss. River Sand & M. Co., St. Louis, Mo.
Proctor, E. J., Genesee Gravel Co., Mt. Morris, Mich.
Powers, S. C., W. S. Tyler Co., Cleveland, Ohio.
Pringle, W. Dick, W. S. Tyler Co., Cleveland, Ohio.
Price, J. P. Eyre, Wyoming Sandy Stone Co., Wilkes Barre, Pa.

Reed, Albert E., The W. S. Tyler Co., Cleveland, Ohio.
Redfern, P. A., Mead-Morrison Mfg. Co., Chicago, Ill.
Reed, John W., Cincinnati Rubber Mfg. Co., Cincinnati, Ohio.
Rice, Carl J., Rice Sand & Gravel Co., Minneapolis, Minn.
Richmond, J. L., Union Sand & Gravel Co., Huntington, W. Va.
Robie, T. M., Fairbanks, Morse & Co., Chicago, Ill.
Root, Ralph R., National Malleable & Steel Castings Co., Cleveland, Ohio.
Roquemore, J. D., Roquemore Gravel Co., Montgomery, Ala.
Ruffins, Chas. L., Sand & Gravel Co., Fredricksburg, Va.
Ryberg, Eric, Utah Sand & Gravel Prod. Corp., Salt Lake City.
Ryder, H. C., The Hayward Co., New York City.
Rust, T. E., Concrete Materials Corp., Waterloo, Ia.
Reinke, F. J., St. Louis Material & Sup. Co., St. Louis, Mo.
Richards, P. M., Bucyrus Erie Co., Detroit, Mich.
Redman, H. W., Koppel, Ind. Car & Equip. Co., Chicago, Ill.
Rogers, Phil K., Rodgers Sand Co., Pittsburgh, Pa.
Ripley, Theron M., County Enginener of Erie Co., N. Y., Buffalo, N. Y.
Radcliff, W. E., Hydro Dredges, Inc., Detroit, Mich.
Rydament, L. J., Ward Sand & Gravel Co., Oxford, Mich.
Reeves, L. L., Columbia Sand & Gravel Co., Washington, D. C.
Rockwood, Nathan C., Rock Products, Chicago, Ill.

Salchenberger, F. S., Morris Machine Works, Baldwinsville, N. Y.
Sallwasser, Wm. H., Wheeling Mold & Foundry Co., Wheeling, W. Va.
Sargent, C. S., The Hayward Co., New York City.
Scott, Robt. S., Good Roads Machinery Co., Kennett Square, Pa.
Schmidt, Fred J., Schmidt Bros. Sand & Sup. Co., Bedford, Ohio.
Settle, J. M., Ohio River Sand Co., Louisville, Ky.
Schifflin, A. K., Link-Belt Co., Chicago, Ill.
Seltzer, J. D., The Thew Shovel Co., Lorain, Ohio.
Shiely, J. L., J. L. Shiely Co., St. Paul, Minn.
Shores, Geo. W., Allis-Chalmers Mfg. Co., Milwaukee, Wisc.
Shotton, B. G., Hendrick Mfg. Co., Carbondale, Pa.
Smith, Earl C., The Osgood Co., Marion, Ohio.

Smith, Harold T., Seaboard Sand & Gravel Corp., New York City.
Shugg, L. W., General Electric Co., Schenectady, N. Y.
Sneeden, J. S., Muskingum River Gravel Co., Zanesville, Ohio.
Stadelman, E. S., Robins Conveying Belt Co., New York City.
Steckel, Chas. C., Steckel Sand Co., Easton, Pa.
Steckel, C. I., Steckel Sand Co., Easton, Pa.
Stephen Stephanian, The Arrow Sand & Gravel Co., Columbus, Ohio.
Stetlion, H. D., Muskingum River Gravel Co., Zanesville, Ohio.
Stiner, H. Wray, General Electric Co., Cleveland, Ohio.
Strube, H. L., Link-Belt Co., Philadelphia, Pa.
Sullivan, Ralph C., Rock Products, Chicago, Ill.
Swanson, G. E., G. H. Williams Co., Erie, Pa.
Stump, W. T., Standard Sand & Gravel Co., Wheeling, W. Va.
Spyer, Elwin G., J. E. Carroll Sand Co., Buffalo, N. Y.
Stelley, H. A., Buffalo Gravel Co., Buffalo, N. Y.
Sinten, Ernest B., The Sinten Material & Transport Co., Manchester, Ohio.
Symes, W. H., The Marion Sand & Gravel Co., Marion, Ohio.
Simons, Henry J., Keystone Sand & Supply Co., Pittsburgh, Pa.
Stewart, W. J., Stewart Sand & Material Co., Kansas City, Mo.
Schott, T. J., Wausau Sand & Gravel Co., Wausau, Wisc.
Shearer, Jesse A., Indiana Gravel Co., Inc., Indianapolis, Ind.
Sauerman, John A., Sauerman Bros., Inc., Chicago, Ill.
Taylor, E. W., Industrial Brownhoist Corp., Cleveland, Ohio.
Thibant, R. G., The Osgood Co., Marion, Ohio.
Thoenen, J. R., U. S. Bureau of Mines, Washington, D. C.
Thorn, L. G., Commonwealth Sand & Gravel Co., Richmond, Va.
Thomas, E. P., Massillon Washed Gravel, Navarre, Ohio.
Thompson, H. B., Peck-Thompson Sand Co., Kansas City, Mo.
Tompkins, E. S., Allen Cone Co., New York City.
Tompkins, G. H., Sauerman Bros., Inc., Chicago, Ill.
Tower, Geo. E., Tower Machinery Co., Cleveland, O.
Trainor, J. A., Taylor Wharton Iron & Steel Co., High Bridge, N. J.
Trauffer, W. E., Pit & Quarry Magazine, Chicago, Ill.
Twohy, John, Commonwealth Sand & Gravel Co., Inc., Richmond, Va.
Tuttle, C. E., American Aggregate, New York City.
Thomson, H. F., General Material Co., St. Louis, Mo.
Turnbull, C. L., Rubber City Sand & Gravel Co., Akron, Ohio.
Thomas, C. C., Ideal Sand & Gravel Co., Mason City, Ia.
Uthoff, G. V., Owen Bucket Co., Cleveland, Ohio.
Upham, Chas. M., American Road Builders Assn., Washington, D. C.
Velde, E. A., Universal Crusher Co., Cedar Rapids, Ia.
Vickery, Harry W., J. W. Carroll Sand Co., Buffalo, N. Y.
Vang, George, Iron City Sand & Gravel Co., Pittsburgh, Pa.
Wagoner, J. H., Brownelle Sand Co., Utica, N. Y.
Walker, Stanton, National Sand and Gravel Association, Washington, D. C.
Walsh, Wm. T., The Day & Maddock Co., Cleveland, Ohio.
Watson, C. W., Lorain, Ohio.
Weimer, Hugo W., Consulting Eng., Milwaukee, Wisc.
Weiss, L. M., Pit & Quarry, Chicago, Ill.
Welch, F. M., F. M. Welch Eng. Service, Greenville, Ohio.
West, H. E., The West Sand Co., Muskogee, Okla.
Wilson, W. A., Rock Products, Chicago, Ill.
Weiblen, Carl F., G. H. Williams Co., Erie, Pa.
Whigham, J. H., Roquemore Gravel Co., Montgomery, Ala.
Williams, L. E., Ray Sand & Gravel Co., Detroit, Mich.
Wilson, Arthur G., Indiana Gravel Co., Indianapolis, Ind.
Winsor, Q. J., The Thew Shovel Co., Lorain, Ohio.
Wyse, F. O., Bucyrus Erie Co., S. Milwaukee, Wisc.
Wettlaufer, E. L., Niagara Concrete Mixer, Toronto, Ont., Can.
Warner, L. K., The Marion Sand & Gravel Co., Marion, Ohio.
Wright, J., W. S. Tyler Co., Cleveland, Ohio.
Walling, Ralph, Kent Sand & Gravel Co., Kent, Ohio.
Westenhaver, J. L., Productive Equipment Co., Chicago, Ill.
Watson, W. T., Holmes Sand Co., Millersburg, Ohio.
Williamson, E. S., Erie Sand & Gravel Co., Erie, Pa.
Williamson, Geo. H., Davison, J. K. & Bros., Pittsburgh, Pa.
Yager, P. A., River Sand & Gravel Co., Owensboro, Ky.
Young, Arthur H., Morris Machine Works, Cleveland, Ohio.
Young, Chas. H., Landers, Morrison, Christonsen Co.
Young, Clark M., Cincinnati, Rubber Mfg. Co., Cincinnati, Ohio.
Zimmerman, Earl, American Aggregate Corp., Cincinnati, Ohio.

Setting and Hardening of Cement

The phenomena of setting and hardening of cement are the same, the latter being a continuation of the former. At the outset, however, there is a certain discontinuity due to the necessity of the cement powder to dissolve in the water. At least one constituent of the cement dissolves and goes into a liquid phase. A super-saturated solution is formed which contains a solid that is stable under the usual conditions. When the new solid phase separates from the supersaturated solution, the solid phase absorbs several constituents of the liquid phase. Following this, the swelling of the constituents of the solid phase is hindered by the absorbed pellicule, and it thus happens that some of the solid constituents remain in the colloidal state. When the supersaturated solution is transformed into the solid phase, more solution is formed from the unstable solid constituents remaining. In this way large agglomerates are formed.—Tutomu Maeda—(In Esperanto. Le Ciment, Nov., 1928.)

Heat Reactions in Cement Setting

The specific heat of the ground clinker used was 0.199, obtained by suspending in toluene and heating electrically. The solid set cement had a specific heat of 0.332 and the powder 0.334. On heating to constant weight at 110-115 deg. C., the cement lost 9.9 per cent of its weight and the specific heat was 0.244. A concrete dam of about 350 cubic meters reached a maximum temperature rise of about 25 deg. in two weeks and then cooled down very slowly. The total heat evolved was at least 48 cal. per kilogram of cement, but in the laboratory the values obtained were considerably lower. The heat evolved varies with the initial temperature.—P. Joye.

An Engineer's View of the Sand and Gravel Situation*

By Major T. M. RIPLEY,
Chief Engineer, Greater Motorway System

IN THE production of gravel it is seldom, if ever, separated from that of sand. In fact, the speaker has never seen the pit from which only gravel could be produced, although small sections of pits at times run to practically pure gravel. Also, sand pits are seldom free from gravel and, so far as the speaker knows, never free when the same are of glacial origin. The producer of gravel, among his other problems has that of disposition of the entire output of his plant and, like the producer of broken stone, he has frequently found it difficult to dispose of the finer portions of his coarse aggregate; namely, that which is called number 1 stone and which is frequently designated as pea gravel.

During the past few years the study for design of concrete pavements has brought more into favor what is known as the two course pavement.

In the original concrete pavement design the full thickness of the pavement was built in one operation, of the same constituency of mix, and in a great majority of cases a much larger proportion of two inch and three inch stone was required than that of a smaller size. In some instances specifications excluded the smaller size—namely, number 1, or pea gravel, on the assumption that a stronger pavement was thereby secured.

The exclusion of this smaller part of the coarse aggregate worked a great hardship upon many producers, as the bulk of their coarse aggregate was of the finer grade, suitable for thin walls, plasters, etc., but being excluded from the great and growing use in highway construction.

Several years ago, George C. Diehl, engineer for Erie County, began building a two course concrete pavement. There were several reasons for attempting this type, but the one in which we are particularly interested is its effect on your production. The first of these pavements in Erie County, exclusive of experimental pieces, was laid in 1925, when 94,809 square yards were put down. From 1925 to 1928 inclusive there it has laid 98.52 miles, equal to 1,021,724 square yards, and during the years 1927 and 1928 the State of New York laid in its western division 33.70 miles, equal to 418,507 square yards. Moreover, the towns and villages in Erie County have laid this pavement with the result that nearly two million square yards has been laid in the Buffalo-Erie County district. What makes this of peculiar interest to the gravel producer is the fact that the top course of this pavement uses as its aggregate the number 1, or pea gravel, exclusive of the larger sizes.

In the early years of this work, it was at first difficult to convince contractors that there was not a material increase in cost of doing the work by the two course methods over the one course method. The steel reinforcement in pavement has become a standard practice in all progressive states and the placing of this reinforcement was usually about two inches from the surface of the pavement, and moreover, as specifications required that the concrete should be screeded to the proper elevation for receiving the reinforcing material, it was brought to the attention of complaining contractors that they were practically building a two course pavement under the one course specifications and that the only difference in the manipulation of the two classes of material was a little more thought exercised in delivering material to the mixture and in proportioning the same. As practically all concrete pavements were being laid from 6 to 8 inches thick, it is readily seen that the number 1 product under the two course pavement design immediately obtained a monopoly on from 25 to 33 1/3 per cent of the total pavement laid. This, in many cases, immediately solved the problem of disposing of the entire product of the finer aggregate from many pits.

The matter of keeping the red figures off your ledger is a matter of vital importance to every producer and one method of doing this is to dispose of your entire product. Therefore, it is the duty of the producer of number 1 gravel to bring this matter of two course concrete pavement to the attention of his clients if they are not already using the same.

This two course pavement was developed in an effort to secure a finished surface, free from checking and cracking. It has been successful under five years of trial. A further development of the two course pavement is a recent patented adaptation known as "Sheet Concrete," which is being put out by the Sheet Concrete Pavement Corporation at 51 East 42nd Street, New York City. We have laid some of this pavement in Erie County, but its age is not great enough to yet predicate any definite statement of permanency therefrom.

Let us see what the use of two course in place of one course concrete pavement would mean, to the producer of number 1 stone, or pea gravel.

*Abstract of a Paper Presented before the Meeting of the National Sand and Gravel Association.

*Assuming the one course to be 1-1½-3 mix, using run of crusher exclusive of sand (below ¼") and number 1 stone in excess of 25 per cent of the coarse aggregate; and assuming the two course pavement to have a bottom course two thirds the thickness of the pavement and 1-2-4 mix, the top course one third the pavement thickness and mixed 1-1-2, using only number 1 for coarse aggregate; then

The one course pavement could contain not to exceed 25 per cent number 1 gravel. The two course will contain 25 per cent of 2/3, equal to 16.6 per cent plus 100 per cent of 1/3, equal to 33.3 per cent or a total of 49.9 per cent. In other words, the use of two course concrete pavement doubles the amount of number 1's allowable in the mix. As the total output of sand and gravel is about 200,000,000 tons per annum, and one quarter of this amount goes into highway work, you can readily compute the value of this 100 per cent increase to the total trade, as well as to the individual producer.

To the producer of large percentages of the finer coarse aggregate, the use of two course concrete pavement offers material relief.

The census of 1920 showed that there were 20,692,204 dwellings in the United States, of which 11,212,654, or over one-half the total, were rural dwellings. On a basis of the normal increase in population, it is conservative to estimate that at present there are 12,000,000 rural dwellings and 22,000,000 total.

The automotive census for 1929 will undoubtedly show at least 24,000,000 motor vehicles in the United States, of which at least 20,000,000 will be automobiles, or nearly one to the dwelling. In 1927, according to the National Sand and Gravel Bulletin of September, 1928, there was sold or used in the United States, 197,454,269 short tons. In the June, 1928, bulletins are tables of "Quantities of Material per Cubic Yard of Concrete," which accompany an article entitled "Tables of Quantities of Materials for Concrete."

Can we not deduce from the foregoing statistics certain rational assumptions which will show some of the market possibilities of the product?

It is only a few years ago that automobiles and motor trucks owned and operated in the rural communities were the exception. Today, this use is universal and the ultimate probability is that practically every dwelling will be represented by one or more motor vehicles. It is a well known fact that these vehicles are not operated economically or satisfactorily upon unimproved roads. Therefore, your ultimate market is not only the main highways through the district, but the driveways from such highways to every house or garage, and, assuming that each rural householder should improve the average driveway with the minimum amount of material which would keep his motor equipment out of the mud, you have a potential market for approximately 60,000,000 tons. And this on the assumption that the urban dweller has already made such improvement. This would be an increase over the 1927 production of 30 per cent.

In the tables of quantities of materials for concrete, it is shown that the increase in aggregate, because of the difference in proportion used of said aggregate or in the amount of water used for the mix, varies from 9 to 12 per cent. Assuming the general average of these to be 10 per cent, we would then have, by using a mix which would produce a good concrete and would carry the maximum amount of coarse aggregate, an increase of 20,000,000 tons over the 1927 output.

The two possibilities just mentioned show a 40 per cent increase as the ultimate which could be obtained therefrom, regardless of the natural growth of the market.

We all are compelled to form our opinions from personal experiences and observations. Therefore, the user gets a different view than the producer. On the other hand, we, the users, sometimes analyze the statistics of a business in which they are interested, and it seemed to me that some of you who have been too busy to make such analyses would be interested in the taking apart of the various units making up the article entitled, "Sand and Gravel Production in 1927." On Page 23 of your bulletin for September, in that table, is given in short tons and value all of the sand and gravel sold or used by producers in the United States, including Hawaii and the District of Columbia. For the purposes of comparison we can leave out Hawaii, where they are getting three dollars a ton for material, as of course such a locality cannot in any way affect the United States market.

In the remaining 49 states and territories we find that the price ranges from 20 cents to $1.14 a ton, the minimum figure being that of South Dakota and the maximum West Virginia. Between such a spread it is impossible to arrive at any conclusion excepting that the materials are not comparable and the use of the same are not comparable; namely, one price might be for sand only which is used for a special purpose and the other might be for bank run of material, hauled directly onto a job. On the other hand, the very title of the table leaves a doubt in one's mind as to whether the price noted in all cases is f. o. b. pit or f. o. b. destination. Nevertheless, one wonders if the spread in price between those states which are large producers is not greater than would be the case if your organi-

*These mixes are here used for comparative purposes, and should not be considered as applying to any particular job.

zation wielded a greater influence among its members. New York State, the largest producer, shows an average price of 61 cents per ton; Illinois, a close second, 47 cents; Michigan, 51 cents; California, 56 cents; Pennsylvania, 87 cents; Ohio, 69 cents; Indiana, 47 cents. All of these mentioned states produce over ten million tons each per annum. It is noticeable that there is a spread in the above figures of 40 cents per ton, or an increase over the minimum of 85 per cent. As before stated, there are undoubtedly many local conditions which affect these prices; yet to the outsider like myself, it seems probable that some very definite information of value to the trade might be secured. A similar table which would separate the sand from the gravel, also the various classes of sand and the use thereof from each other, would be of value. A study of such information would enable producers to determine if his prices were in line; also what was the proper average value, and assist in the elimination of cut-throat competition.

An increase of 10 cents per ton in the selling price of your product could easily mean the difference between profit and loss, and such increase could, in many instances, be paid without curtailing the output. You are in this business to produce a good product and secure a livelihood in so doing, and a few hours or even a few weeks spent in investigation might be of more value than running the washing plant for a much greater length of time.

Constitution of Portland Cement

In cooperation with the Portland Cement Association, researches which may be divided into three main classes have been under way by the Bureau of Standards. They include:

1. Studies on the constitution of portland cement.
2. Studies of the reaction of setting and hardening and the behavior of cement in use.
3. The influence of each component on the temperature required to burn the cement and on the cementing value of the product.

Seven investigations in this program have been completed and reported during the period.

The investigations on the constitution of portland cement during this period have been concerned primarily with systems in which ferric oxide and magnesia are components. These studies have shown the existence of two new compounds. These have the formulae 4CaO, Al_2O_3, Fe_2O_3 and 4CaO, 2MgO, Al_2O_3, Fe_2O_3. These compounds form a complete series of solid solutions with each other. The Fe_2O_3 in portland cement is probably combined either as 4CaO, 2MgO, Al_2O_3, Fe_2O_3 or its solid solution with 4CaO, Al_2O_3, Fe_2O_3. The other studies on magnesia show that any MgO in excess of that required to combine with the Fe_2O_3 as 4CaO, 2MgO, Al_2O_3, Fe_2O_3 possibly remains as uncombined MgO in the cement.

In a research reported last year, the behavior of the cement compounds in an excess of water was studied. That work has been extended this year to the behavior of those compounds in concentration of water similar to those used in concrete practice. The materials are made into paste with water and sealed in glass vials. At regular intervals the vials are broken away from the specimens and these tested for compressive strength and water of hydration. Microscopic and x-ray examinations of the specimens are made to determine the nature of the end-products of these reactions. So far $Ca(OH)_2$ and hydrated 3CaO, Al_2O_3 are the only crystalline products which have been identified.

In another investigation the pure compounds, laboratory cements, and commercial cements are made into mortar specimens and these immersed in solutions of salts. The salts used are those found in sea and alkali waters. The specimens are examined at regular intervals for corrosion and for compressive strengths. These investigations are not completed, and no correlation of results can be made at this time.

Systematic studies are being carried on to determine the effect of each component upon the temperature required to produce cement and upon the cementing properties of the product. The components of the mixtures are caused to vary by replacing a part of one by another or by direct addition of one to a given mixture of other components. Starting with a base mixture of CaO, Al_2O_3, and SiO_2, it has been found that replacing a part of the CaO by MgO or a part of the Al_2O_3 by Fe_2O_3 or both generally decreases the temperatures required to burn the mixtures to complete combination. In general, the replacement of Al_2O_3 by Fe_2O_3 increases the strength of the cement; whereas, the replacement of CaO by MgO usually causes a slight decrease in the strengths of the cements. The addition of MgO to the mixture usually affects the strengths very little.

All of the studies on portland cement require the use of such tools as the petrographic microscope and x-ray equipment. The x-ray diffraction patterns and optical properties of many of the compounds encountered in these studies have been determined and published.

Sand Lime-Brick Association To Hold Convention

The Twenty-fifth Annual Convention of the Sand-Lime Brick Association will be held in the Mayflower Hotel, Washington, D. C., on February 5, 6 and 7. An interesting program will be presented by specialists in the various lines, together with many entertaining features.

Use of Gravel as Railway Ballast*

By J. A. HEAMAN,
Chief Engineer, Grand Trunk Railways

OWING to the rapidity with which railway construction proceeded on this continent during the last century and the necessity of keeping the cost of the tremendous mileage thus created, most of it through partially developed or undeveloped country, as low as possible, the American Railroads did not provide the drainage of the roadbed or the ballast foundation for the track that was considered necessary on the European roads. As a result, tie renewals have been high, heaving of track has been excessive and a smooth riding track difficult to maintain. The more important and heavier traffic roads have, however, been diligently improving their roadbeds and all railroads giving more and more attention to improved drainage and ballast. There is no difference of opinion among railway men as to the economy of this work; the increased cost of cross ties and the necessity of preserving our timber resources alone being almost a determining factor.

The use of bank run gravel for railway ballast is practically contemporaneous with the construction of railways on this continent. It was generally readily obtained adjacent to the railway, and furnished, when of fair quality, good drainage and a firm foundation for the track structure and all at a low cost. It is still the material most generally used in ballasting railways and will be for many years to come on the less important lines.

Bank run gravel, however, excepting rate deposits which occasionally are available, has characteristics varying with each deposit, and usually detrimental in their effect. These peculiarities limit or defeat the results which might otherwise be obtained from its use in many ways, most frequently as to stability and drainage of the roadbed and usually in creating a dust nuisance which is not only harmful to rolling stock, but most disagreeable to patrons of the railway.

It is in improving the natural deposits by removing their objectionable characteristics that the National Sand and Gravel Association come into the picture. Better ballast at low cost, and more of it, is a problem in which this Association has furnished a great contribution to improved railway service in this country and I am of the opinion that the treatment of gravel for railway ballast is but in its infancy.

In determining the type and quality of ballast to be used on any section of railway, consideration should be given to, among other features, the following:

Allowable expenditure
Maintenance charges
Character of traffic
Available material

It is apparent that expenditure and available material are intimately related, and where gravel susceptible of a treatment which will give a satisfactory ballast is available, this source of supply should have careful consideration; always, however, the question of cost will intrude and frequently the bank run gravel is the result.

The cost to the railway company of bank run gravel as compared to a washed and crushed ballast is not all apparent on the surface. The advantages of the freedom from dust and the better drainage is of course appreciated, but the fact that in the average deposit—at least in Michigan, with which I am most familiar—carries about 45 per cent of sand, all of which must be hauled at an approximate cost of 7 mills per ton mile, must be unloaded and placed under the track at a considerable cost, is sometimes overlooked. This sand, beyond a small percentage, is not only of no advantage, but is harmful, serving only to clog the drainage.

Again there are frequently gravel deposits available along the railway which are unsuitable for ballast as bank run material, but which on treatment make an excellent ballast, and the saving in haul may pay or more than pay for such treatment. In my opinion, the possibilities of improving the ballast on any section of line with a better quality of gravel ballast by treatment should be given very careful investigation when ballasting is under consideration, as the use of this improved material raises no question of changes in maintenance methods which the substitution of a more expensive material involves. There is here, a line of endeavor open to your Association; namely, the utilization of abandoned railway gravel pits by treatment and the furnishing therefrom a satisfactory ballast both to the advantage of the railway and the operator.

Whether or not movable plants can be developed to do the work economically is a question which you undoubtedly can determine, if the suggestion is worthy of consideration.

In re-ballasting a section of single track railway, say 100 miles in length, the average amount of ballast required for say a lift of ten inches would

*Abstract of an Address Delivered before the National Sand and Gravel Association, January 10, 1929.

be 350,000 tons and should be applied in not over two years, frequently in one. The cost of installing and removing a plant to another location, less depreciation, etc., can be divided among 350,000 tons.

In considering gravel, when untreated or treated, for use as ballast, it is necessary to bear in mind that gravel is a natural product and nature is an eccentric mistress. There is little satisfaction in a specification calling for a material which the gravel in the district will not furnish, such, of course, is inexcusable, but a specification written to cover a ballast which tests in an available pit appear to justify, may on operation prove out of line, and this is to say the least disappointing. The necessity for ample and complete test of available supplies is imperative.

In planning a railway ballast operation, the railway must be assured of a uniformly regular supply, so that its work gangs can be kept economically employed throughout the working season. This means that the character of the gravel pit and the certainty of it furnishing a satisfactory material must be known.

Frequently ballast production is not the most important nor the most remunerative of the operations of a gravel washing plant and with a large demand for concrete aggregates the ballast production suffers. The railway naturally is desirous of securing the lower price coincident with joint operation, but the two should be coordinated and the plant provided to give during the rush season at least the minimum agreed upon with the railway. If known in advance that during certain seasons a minimum delivery only can be expected, the railway forces can be adjusted accordingly at much less cost than occasioned by an intermittent supply. Negotiations with railways in which the lower cost of ballast if taken so as to fill out a full production, except during a short rush period, may show how this problem may be handled.

The failure of gravel companies to furnish a uniform supply of ballast has frequently caused the railway to go back to its old pits and resurrect the old shovel which did at least furnish the material as and when required.

It would hardly be fair of me to inflict on this Association much detail regarding specifications for washed gravel ballast and specifications as to pit run are not very material, it usually being gravel from pits on the line and accepted on that account being low in first cost. However, it may be interesting to note that there has been during the last few years quite a change in the views of such a body as the American Railway Engineering Association on washed ballast. The specifications adopted previous to 1926 provided for not more than 20 per cent sand and not less than 15 per cent. The revision recommended in 1927 specifies certain percentages of crushed material which shall be accompanied by certain percentages of stone between 1½ inches and 1/10 inch with fairly wide tolerance allowed. The sand passing 1/10 inch ring is, however, cut to 3 per cent and the larger dimension reduced to 1½ inches, from 2½ inches. These specifications cover washed ballast containing from 0 to 20 per cent: 20 per cent to 40 per cent crushed material. The A. R. E. A. specifications indicate the need of crushed material in washed gravel ballast to satisfactorily hold the track in line and prevent creeping and with this most railway engineers will agree. The suitability of a gravel deposit for use as washed ballast more frequently depends upon the amount of material in it large enough to require crushing than upon any other factor.

There is some difference of opinion among railway men as to the amount of sand allowable or desirable in railway ballast. My own view is that it is no more desirable in washed gravel ballast than in crushed stone ballast if the requisite amount of crushed stone is available to give a stable ballast and I would not favor a washed gravel ballast lacking this characteristic.

During the last three years the Grand Trunk Railway has ballasted the Chicago-Port Huron line between Hayford and South Bend 76½ miles of double track railway. This is a part of the program of ballasting this line between the two points first mentioned. In this work there has been used 700,000 tons of washed gravel ballast. The results have been generally satisfactory, a dust free, smooth riding track being the result. In the maintenance of this track it has been found unnecessary to change the maintenance organization in any respect and it is believed the maintenance charges will be less than with broken stone and equally satisfactory.

Heat of Reaction of Portland Cement and Water

A study of the heat of reaction of portland cement and water is in progress by the Bureau of Standards.

The cement is mixed with a definite proportion of water in a small can, a thermocouple placed in the cement mixture, and the can fitted into a thermos bottle. The latter is then placed in an insulated cabinet maintained at 21 deg. C.

The temperature changes taking place during the first 24 hours are recorded on a potentiometer. Relative values were obtained on a large number of commercial portland cements, special early strength cements including high alumina cements, and also on some of the pure compounds of cement.

An endeavor was made to correlate this heat of reaction of cement with the strength, fineness, time of set, the ratio of SiO_2 to Al_2O_3, the ratio of CaO to $SiO_2+R_2O_3$, CaO, and volume changes.

Storing Cement for Demand*

IT OFTEN becomes necessary to store cement for prolonged periods of time under conditions and in places where climatic and commercial circumstances make this essential. It is common that a certain short lapse of time should almost always intervene between the manufacture of the cement and its eventual use in making concrete, etc. It, therefore, follows that the action of storage of cement on its qualitative properties is a matter which is of the highest interest and importance not only to the cement manufacturer but to the user as well.

A great many investigations have been carried out in various countries on this question which were carried out under special or existing conditions of storing the cement. The obtained results, accordingly, vary quite considerably because of this circumstance, and this is ascribable partly to the conditions under which the different cements were investigated and partly to the fact that the cements stored differed among themselves in common characteristics. On the other hand certain conclusions can be drawn from these experiments and investigations.

Cement can be stored for months without any change being noted in its properties. On the other hand certain improvements are noticed in fresh cement during the first months of storage. Nevertheless, after the packed cement has been stored over a certain maximum period of time, there is a certain deterioration in the cement, which varies in individual cases.

Air contains a certain proportion of moisture without any consideration being paid to the weather conditions or the time of the year. If the moisture content of the air is considerable in those places where cement is stored or if a normal amount of moisture is contained in the air in rooms or places where the cement is kept for a long period of time, then this moisture is absorbed by the cement to a certain extent, for cement is a hygroscopic substance. The cement thus becomes "air-set," "hard."

This tendency for "spontaneous setting" is, in this case, the most important cause of the deterioration of the quality of the cement. If the lumps of cement are no harder than can be broken into pieces between the fingers, then there is scarcely any danger that the quality of the cement has suffered any deterioration. On the other hand, if the lumps have become "stone-hard," then naturally the cement is absolutely useless. In general, it may be said that these lumps consist of set and hardened cement and hence can no longer be considered as a bonding agent. Cement, which has not been stored in the proper manner, can suffer much deterioration in quality after a comparatively short space of time.

These lumps must be differentiated from the denseness caused by packing the cement tightly in bags and the like. This condition is absolutely non-injurious to the cement.

In order to determine the measure in which cement is affected by storing in the ordinary manner that is in bags for indefinite periods, twelve different cements were subjected to various treatment in the laboratory. The investigation was carried out in the following manner.

Each cement was tested in accordance with the Swedish standards and was found to meet the specifications. The cement samples were then stored and tested as follows:

0. The test was made directly after the sample was received in the laboratory.
1. The cement was stored in bags in a shed for one month.
2. The cement was stored in a shed for two months.
3. The cement was stored in a shed for three months.
6. The cement was stored in a shed for six months.

The various cements were received as far as possible in the fresh condition directly from the cement mill after manufacture. The cement was kept in paper bags in the shed. These bags or sacks, three of which were employed for each kind of cement, were placed in an upright position on a wooden floor which was about one foot above the level of the ground.

The various cements were designated by number and the results obtained from the testing are given in terms of percentage of values obtained in the "O" series of experiments. These relative values are designated as "modulus of compressive strength," "modulus of tensile strength," etc.

(The original article contains a number of tabulations giving the strength figures obtained in testing the cements after various periods of storage. Trans.)

Because as the average cement is never stored or kept unused for more than a six months period, it was not thought advisable to prolong the tests beyond such period of time. The results allow the following conclusions to be drawn.

In the first place, it is clear that storing cement for varying periods of time has a different effect on one cement than on another. Furthermore, as far as strength is concerned, the effect of storage will even vary on one and the same cement. Consideration must be paid to the age of the sample of set cement before the latter is tested. Thus the variable effects are more pronounced in the two

*A Contribution from the Laboratories of the Swedish Cement Sales Company, "Cements," Victor Baehrner. Zement, 1928, pages 1556-9.

day test samples than in the twenty-eight day test samples.

After the cement had been stored for three months, the modulus of compressive strength was reduced on the average to 93 per cent of its original value in the fresh cement, and to 87 per cent of its original value, when the cement was stored for six months. It was furthermore established that the modulus of tensile strength was affected to a slighter degree than the modulus of compressive resistance. Further, the time of setting was retarded to an inconsiderable degree.

It must also be remembered that storing the cement under better conditions than in a mere shed, that is under the regular storage conditions that apply in the course of buying and selling cement will not have so marked an effect on the properties of the cement as when the latter is stored, as in this instance, in sheds. In fact tests have shown that cement can be stored for double the time in a good storage place as in a bad place without the strength of the cement being reduced at all.

As far as storage of cement in the cement mill is concerned, this is of course carried out under the best of conditions and it has been found that cement may be kept for as long as one year in the cement storage house without suffering any deterioration in quality.

These investigations have also shown that special grades of cement, that is super-cements and the like, are more unfavorably affected by storage than regular grades of Portland cement. Nevertheless, when the tests were carried out on samples which were allowed to set and harden for twenty-eight days, no difference was found in the results.

Cement Mills Operate Without Accident

Accident prevention work in cement mills has reached a startling degree of effectiveness, according to the Portland Cement Association, in a recent announcement that 18 mills, owned by 12 different companies, operated in the United States and Canada throughout 1928 without a single lost time accident. Each of these plants will receive the Association sculptored concrete trophy awarded annually to cement mills operating the entire calendar year free from mishap.

In 1927 ten plants won trophies, or more than twice as many as had accomplished the feat since accident records of the industry had been kept. The 1928 trophy winners number more than the total of all previous winners.

Of the 150 competing mills three have received the trophy for two consecutive years, a remarkable record in accident prevention, the announcement points out. They are located at Ironton, Ohio; Cowell, California, and Iola, Kansas.

Winners of the 1928 awards are at Bellevue and Quincy, Michigan; Ironton and Painsville, Ohio; Manheim, West Virginia; Exshaw, Alberta; Mildred and Iola, Kansas; Cowell, California; Bath, Ormrod, Sandts, Eddy and Fogelsville, Pennsylvania; Cape Girardeau, Missouri; Oswego, Oregon; Kingsport, Tennessee; Dallas, Texas, and Norfolk, Virginia.

Sulphates on Portland Cement

Mortar bars 1/8 x 5/8 x 7½ in. were made from the active components of Portland cement and standard Ottawa sand, distilled water being used for gauging. The mixes used were either 1 : 5 or 1 : 7.5. After curing, the bars were placed in sulphate solution and the expansion measured over a period of two years. Sodium sulphate solutions react on only one of the constituents of Portland cement, tricalcium aluminate, whereas magnesium sulphate reacts on all three constituents. The reaction is more rapid, however, with the tricalcium aluminate. Mortars made from tricalcium silicate and from dicalcium silicate with the addition of tricalcium aluminate disintegrated rapidly in solutions of both sulphates. Steam treatment of the mortars increased the resistance to the sulphate solutions enormously. The action of the steam affected both lean and rich mortars equally, and appears to be chemical.—Thorvaldson, Vigfusson and Larmour (Trans. Royal Soc., Canada, 21, Sec. III, 295-310) and C. A.

Adjustability of Rapid Hardening Concrete

The age, kind of cement, consistency of batch, type of aggregate, mix curing and size of test pieces were the factors considered with reference to the ability of concrete to adjust itself under test. The modulus of elasticity (E) was found to increase with the age of the specimen, and to be greater for the rapid hardening cements than for the normal Portland cements. Factors decreasing the value of E are increased water content increased size of specimen, and increasing tension. Aggregate graded small and having a large percentage of voids also decreases this modulus. For like dimensions E for compression is greater than E for tension. With increasing strength, the ratio of compression E to tension E decreases. In general the factors increasing the strength of concrete also increase E.—B. Möhlmann. (Zement, 1928. 390, 581, 619, 658, 691, 1137 and C. A.)

The Corrosive Quality of Slag

THE National Slag Association of Cleveland, Ohio, has published the tenth of a series of symposiums devoted to blast furnace slag. This symposium, entitled "Is There Any Corrosive Quality in Slag?" contains abstracts from technical magazines and papers, as well as statements from recognized authorities. The following article contains abstracts from this symposium.

Is There Any Corrosive Quality in Slag?

"Probably the most persistently recurring Nemesis of the slag producer is the question of the detrimental effect of slag on reinforcing steel in concrete. This is in spite of the fact that there has never been a well authenticated case of such effect, and that the most prominent concrete authorities have expressed their decided belief that such action cannot and does not happen in well made concrete. If the concrete is dense and the steel is placed a proper depth below the surface, every possible protection has been afforded."

It is pointed out that if slag had any corrosive effect on steel, it would have come to light in connection with other uses of the material than reinforced concrete, where the steel is protected from air and moisture. As an example, 41 slag sewage disposal beds in various states in which pipes were covered with slag showed no signs of pipes deteriorating any more rapidly than in stone and slag beds. The case of the Carnegie Steel Company office building in Youngstown, Ohio, is also cited. This building has its piping laid through a slag fill, but after thirteen years there has been no evidence of ill effect on the piping.

Dr. E. C. E. Lord, petographer of the U. S. Bureau of Roads, says, "In regard to the sulphur content of slags as compared with that of portland cement, I would say that in the former the sulphur exists essentially as calcium sulphide, while in the latter it is present chiefly as sulphate. While both these sulphur compounds are about equally soluble in water, the fact that the sulphate has been added to the cement clinker after burning renders it far more readily attacked by water than is the sulphide of the slag, since the latter salt crystallizes simultaneously with the other compounds and consequently forms an integral part of the solidified product."

The Atlas Portland Cement Company, New York, in the "Atlas Handbook on Concrete Construction" published in 1927, says that blast furnace slag has found an increasing rise as a coarse aggregate for concrete and that the Bureau of Standards states that the sulphur content need not be specified. The U. S. Bureau of Standards, in "Blast Furnace Slag as Concrete Aggregate" published in 1921, states that tests showed no signs of disintegration.

Professor H. Burchartz, staff associate of the Department of Testing Materials, Berlin-Dahlem, Germany, in "Experiments with Blast Furnace Slag" published in Stahl und Eisen in 1917, gives the results of tests made. Reinforced slag concrete and reinforced gravel concrete samples were stored in air, water and seawater for periods up to 3 years and observations made of both concrete and reinforcement. No difference was found in the slag and gravel concretes.

The Department of Scientific and Industrial Research, London, England, in 1927 published Special Report No. 10 entitled "Slag, Coke Breeze and Clinker as Aggregates," by F. M. Lea and F. L. Brady of the Department. This report states that steel remains free from rust when embedded in a slag concrete, provided that a dense product is obtained. Calcium sulphide has been found unoxidized in concrete after ten years, and many examples of slag concrete containing 2 or 3 per cent of sulphur as sulphide have good records.

The symposium concludes by directing attention to several points which present a strong argument against the possibility of slag having any corrosive effect on reinforcing steel, providing the concrete is of sufficient density and thickness to prevent the passage of moisture, a condition which must be observed with all aggregates, regardless of their chemical composition:

(1) Laboratory tests show that practically all blast furnace slags have an alkaline reaction in water, which theoretically makes it impossible to produce an acid corrosion.

(2) The sulphur compounds in slag are in the form of sulphides, which, under the alkaline conditions of slag, do not give rise to other compounds having an injurious effect on the steel after being placed in concrete.

(3) Iron pipes covered with slag in sewage disposal beds and subjected to unlimited quantities of air and moisture for as much as 21 years have shown no evidence of ill effects from the contact with slag under these extremely severe conditions.

(4) Iron pipes laid in slag fills have given satisfactory service over periods up to 13 years, although subjected to air and moisture while in contact with the slag.

(5) The test of practical service in the field shows that steel emerges from old slag concrete in the same condition as it entered.

(6) There is at least one case on record where such steel, taken from old slag concrete, was used over again in new construction—sufficient proof of its soundness.

(7) Many of the largest steel companies in the country have used slag for 25 years or more in their reinforced concrete construction, placing slag concrete around the steel manufactured in their own plants.

(8) As a final proof that slag will not cause rusting, Prof. Burchartz's tests may again be cited, to show that bright, clean bars are maintained in that condition in slag concrete, while rusty bars are cleaned of their rust in varying degrees in slag concrete, but in all cases to a greater degree than in comparative gravel concrete.

Outlook for Maine

Signs of a general revival of activity in the famous old granite quarries of Maine, from whose stone some of the nation's greatest artistic and industrial monuments have risen, are appearing in many sections of the State. For the first time in more than ten years, in fact, leaders here see prospects of a real return of prosperity to what was once a major Maine industry.

Granite companies which have prospered despite the general depression are enlarging their plants. A half dozen old plants, partially or wholly abandoned since the outbreak of the World War, are returning to operation. Several of these have been financed by outside capital and set up on a scale much larger than before. Representatives of quarry companies are also out to get Maine's share of the business presaged by the passage of the Elliott Bill providing for an expenditure of $290,000,000 in the next ten years for construction of Federal buildings throughout the country.

Aside from Federal business, it is predicted that the swing back from wholesale use of limestone and cement will bring about the consumption of more granite in the United States in the next ten years than in the history of the industry. It is estimated that there are now $127,000,000 in contracts east of Louisville for buildings in which granite is to be used. These call for $16,000,000 of stone, the remainder representing labor and other material. It is furthermore contended that this swing backward is a normal reaction to needs which the last ten years have shown can be supplied by no substitute for granite.

Maine contractors are already under way with profitable new business. Part of the new Arlington Memorial Bridge connecting the Lincoln Memorial, in Washington, and the amphitheatre on the Virginia shore, with its tomb to the Unknown Soldier, is to be supplied by the Hallowell Granite Works at a cost of $150,000. Builders of the new 13-mile, $40,000,000 boulevard in New Jersey are getting 45,000 paving blocks each week from the Oak Hill quarry in Waldo County. The top layer for the New Orleans breakwater is coming from Rockland.

Despite the difficulties the business has faced, Maine is proud of having retained her place as one of the foremost granite producers. In 1905 the output was valued at $2,750,000, and the state's dressed granite had a market value of $1,648,687, representing nearly a third of the national production. In the same year Maine's production of paving blocks represented one-seventh of that in the United States. Twenty-one years later, or in 1926, one finds Maine leading the nation in construction granite and taking second place in monumental work. In 1927 Maine again led in production of building stone.

To keep pace with the new business coming in, quarry companies are fitting their plants with the most modern appliances. Batteries of electric derricks, giant gang saws and new trackage are being installed. One of the romances of the present opening period of prosperity in this state had its inception in the casual glance of a contractor at a piece of paving block dug out of a New York street. Although the block was laid more than 40 years ago, its condition was perfect. The contractor set to work to discover its origin, and found that it came from Waldo County, Me. The result is the revival, by a group of New Yorkers, of the old Oak Hill quarry which had been idle for years.

Maine's Congressional delegation and the Associated Industries of the State are making a determined drive to put the granite industry on a new plane of production and quality. Quarrymen are also working through the five-year program of the American Granite Association, and all in all the outlook for this lapsed industry in the Pine Tree State is better than in its history.

New Corporations

Liberty Stone Co., Rudolph, Ohio. $10,000. H. S. Anderson, B. O. Mong, W. C. Vivian.

Carolina Marble Products, Inc., Andrews, N. C. 300 shares n. p. v. To quarry limestone and marble. J. A. Martin, J. C. Christie, Catherine G. Martin.

New England Gypsum Co., 458 Columbia Rd., Dorchester, Mass. $100,000.

Loftus & Pepper Co., St. Louis, Mo. $75,000. Sand and gravel. W. B. Loftus, Walter B. Pepper, Chas. E. Sharkey.

Maritime Portland Cement Co., Ltd., Brookville, N. B., Can. $1,000,000. G. E. Chester Gandy, R. D. Paterson, Harry E. Reardon, T. P. Regan, Stanley G. Olive, all of St. John, N. B., Can. Gypsum and clay deposits will be developed and a cement plant built at Brookville, four miles east of St. John, where the head office will be located.

Geo. Hanbury & Son, Inc., W. Palm Beach, Fla. To operate quarries, lime kilns, cement and plaster mills. Geo. Hanbury, Terrence P. Hanbury, Dale A. Nelson.

Marlbrook Lime Co., Inc., Roanoke, Va. $100,000. To quarry limestone and marl and manufacture lime. J. A. Jamison, Pres.

Pacific Aggregates, Inc., care Clark & Heafey, Latham Square Bldg., San Francisco, Calif. 1,200,000 shares n. p. v. Merger of several California companies.

Hy-Rock Products Co., Evansville, Ind. $30,000. Formed by Globe Constr. Co., Evansville, to take over holdings of Marengo Crushed Stone Co., Marengo, Ind. Edgar Traylor, Pres., Evansville; Henry C. Roetzel, V. P., Boonville, Ind.; Arthur H. Mann, Sec.-Treas., Evansville. Offices will be maintained in Evansville.

Van Camp Sand & Gravel Co., Cincinnati, O. $600,000. John V. Campbell, Chas. H. Elston, Pauline E. Smith.

Valley Sand & Gravel Co., Beachwood, Ohio. 100 shares n.p.v. John D. Schwartz, Arthur F. Brown, Alfred J. Gericke.

Cape Girardeau Sand Co., Cape Girardeau, Mo. $20,000. Peter H. Deimund, L. Deimund, Elsie M. Cummins. Will produce sand and gravel on Mississippi river.

Donara Sand & Gravel Corp., Mineola, N. Y. $5,000.

Robinson Sand & Gravel Co., Brunswick, N. Y. $20,000.

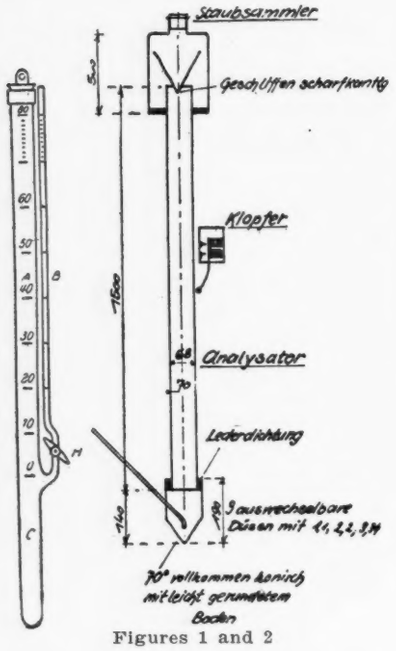
Packing and Distributing Plant for Memphis

The Marquette Cement Manufacturing Company, of Chicago, is completing plans for a packing and distributing plant to be erected at Memphis, Tenn., to be operated as a unit of the company's plant at Cape Girardeau, Missouri. The plant will be of reinforced concrete construction and will include three large storage bins, docks and material handling equipment. A fleet of five barges and one tug boat will be used to transport all bulk material. The entire plant will be electrically operated. F. L. Jacger is southern division sales manager of the company.

Alabama Portland Changes Name

January 1 the name of the Alabama Portland Cement Company was changed to the Lone Star Cement Company. On the same date the names of the other subsidiary companies of the International Cement Corporation, formerly with the state names, were also changed to the Lone Star Cement Company.

PIT AND QUARRY FOREIGN DIGEST



Figures 1 and 2

Determination of the Grain Size of Cement

The size of the grains is sometimes estimated microscopically, but the method is uncertain and unsatisfactory. Determination by means of fluid media is largely used. This method consists of suspending a slurry of the cement in a liquid of known gravity, in a narrow tube, and measuring the height of the cement particles. Figure 1 shows the sedimentation apparatus of Wiegner as modified by Gessner. The cement powder is charged into tube A and the liquid into tube B. Use is also made of air flotation to determine grain size. The apparatus designed by Pearson and Sligh is shown in Figure II and that of Perrott and Kimney (lower part) is shown in Figure III. The particles of the material examined are charged at the top and a current of air under definite pressure is introduced at the bottom. A column is produced of various densities dependent upon the size of the grains. The apparatus shown in Figure IV is patented in Germany for this purpose. It consists of three parts, the cylindrical tube A, the cup shaped part B and the glass connection C. A and B are made of brass. The air current is introduced at C. If the speed of the air current in the blast cylinder of radius r of such a magnitude that it carries with it particles of maximum radius p, and the radius of the glass connection as shown in Figure IV is $\frac{1}{2}$r, then all particles whose radius is less than 2 p, will be blown into the cup shaped part B. Particles once blown through the tube A are prevented from re-entering this tube by means of the cone K and the bell shaped part T, so that particles are separated from the remainder of the mass according to the speed of the air current. By standardizing according to known particle size, the grain size of cements can be quickly and accurately determined. Very large particles are determined by sifting.—H. W. Gonell (Zement, December 20, 1928.)

The Burning Process in Automatic Shaft Kilns

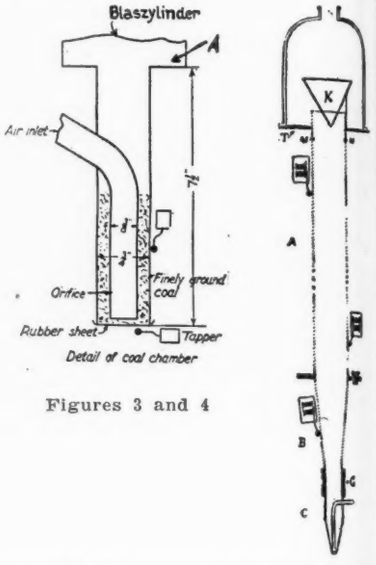
Carbon, oxygen and carbon monoxide are all present in the shaft kiln under conditions which permit of six possible reactions among these three substances. These are:

1. $2C+O_2=2CO$ (not reversible).
2. $C+O_2=CO_2$ (not reversible).
3. $2CO+O_2=2CO_2$ (reversible).
4. $2CO_2=2CO+O_2$ (reversible).
5. $C+CO_2=2CO$ (reversible).
6. $2CO=C+CO_2$ (reversible).

Whether, in any given case, carbon and carbon dioxide react to form carbon monoxide depends upon the temperature and upon the pressure of the reaction chamber. The effect of temperature variation alone, at atmospheric pressure is shown in the accompanying table the temperatures being degrees centigrade.

	CO_2	CO
500 deg.	95 %	5 %
600 deg.	77 %	23 %
700 deg.	42 %	58 %
800 deg.	25 %	75 %
900 deg.	3.5%	96.5%
1000 deg.	0.7%	99.3%

At 750 deg. C. the dissociation of calcium carbonate used in cement manufacture is appreciable, and the table indicates that at this temperature as much as 75 per cent of the carbonic acid can combine with the carboniferous fuel to form carbon monoxide. At higher temperatures this tendency will go almost to completion. These possibilities are not actually reached in practice, but are modified by such factors as the hardness of the fuel. The reaction to form carbon monoxide may not be complete until the temperature rises to about 12-1300 deg. C. (2,200 to 2,400 deg. F.). Raw slip mixed with 10 per cent anthracite burns completely in 10 minutes on the small scale, but if quartz powder is substituted, the burning requires a much longer time. This may be explained by the free play of the air under these conditions and also by the fact that the slip liberates carbon dioxide with resulting formation of a porous structure. The flue gases from the shaft kilns contain more carbon monoxide than can be accounted for by the fuel added due to the initial formation of carbon dioxide with subsequent reaction with the hot unburnt fuel to form carbon monoxide. The particles of slip sinter first on their surface due to the fact that the reaction between the fuel and air first occurs at this surface. Consequently, the surface of the particles first reaches the sintering temperature. Reduction occurs to a great extent throughout the clinker not because of occluded fuel dust, but because the presence of an excess fuel in the kiln causes a formation of an excess of carbon monoxide which effects the reduction. The reaction of the fuel is a surface reaction, whether it takes place with carbon dioxide or with air, and this accounts for the necessity of extremely fine grinding of the coal used.—Hans Kuhl (Zement, December 6, 1928).



Figures 3 and 4

Production of Porous Concrete, Etc.

Material for the production of porous concrete comprises Portland cement, etc., zinc or aluminium powder, and liquid or solid grease, e. g. stearin, which is preferably mixed previously with the metal powder in the absence of air.—Aerocrete (Foreign), Ltd. and C. Nicol (British Patent 299,484). B. C. A.

INTIMATE NEWS OF MEN AND PLANTS

Penn-Dixie Plant Receives Award

The Pennsylvania-Dixie Cement Corporation plant at Kingsport, Tenn., has been awarded the Portland Cement Association Safety Trophy for operation throughout the calendar year of 1928 without a lost-time accident to any employee.

In discussing the award Blaine S. Smith, President of the corporation, said: "The record of our Kingsport plant is most gratifying; while the trophy was awarded for the calendar year of 1928, this plant has gone 486 consecutive days without a lost-time accident. This has been only possible through the hearty co-operation of every employee, and the members of the entire mill organization of our Kingsport plant should look upon this trophy with pride as evidence of a notable achievement."

The Portland Point mill of the corporation operated without a lost-time accident through 1928 until the last few days of December, thereby missing the award of one of the Association trophies. Mr. Smith stated that the 1928 accident record of the other Penn-Dixie plants has been excellent and that the spirit within the organization was such that he looked forward to an even better showing in 1929.

In addition to the plants at Kingsport, Tennessee, and Portland Point, New York, the Pennsylvania-Dixie Cement Corporation operates five cement producing mills in Pennsylvania, Tennessee and Georgia, with a total annual capacity of 11,000,000 barrels for all mills. The company is one of the major factors in the cement industry and has contributed wholehearted support to the campaign of accident prevention sponsored by the Portland Cement Association.

Ohio River Sand and Gravel Company Sold

Capt. Robert H. Noble, of Paducah, Ky., owner of the Ohio River Sand and Gravel Company, has sold his holdings to the Kentucky Consolidated Stone Company, of Louisville.

A. J. Hoffman, President of the Kentucky Consolidated Stone Company, said the Paducah plant will be an important unit of a great consolidation affecting several large sand, gravel and rock crushing plants located in Kentucky, Missouri, Tennessee, Mississippi and Arkansas.

Max A. Burns, Publicity Manager, Universal Portland Cement Company, who was elected chairman of the Advertising Council of Chicago on January 10

Advertising Council Honors Universal Portland Man

Active in the construction field in both an engineering and an advertising capacity, Max A. Berns, publicity manager of the Universal Portland Cement Company, was on January 10 elected chairman of the Advertising Council of the Chicago Association of Commerce. He succeeds Homer J. Buckley, who has served as chairman for five years.

In the engineering and construction field Mr. Berns has been identified with the movements for winter building, for fire-safe construction, for grade separations and for wider roads and streets. He is a member of the good roads committee and the street traffic committee of the Chicago Association of Commerce; was chairman last year of division 15—contractors and building material—of the association; and is a member of the committee on advertising and publications of the Portland Cement Association. t

Mr. Berns has been associated for 15 years with the Universal company, a subsidiary of the United States Steel Corporation. He graduated from the University of Illinois, College of Engineering, and in the World War served as captain of Engineers, U. S. A. He is a member of the Chicago Engineers Club, Western Society of Engineers, American Society of Civil Engineers, Society of American Military Engineers, Engineering Advertisers Association, National Industrial Advertisers Association and International Direct Mail Advertising Association.

Canadian Operator Visits Plants in States

H. L. Fisher, of the Saskatoon Sand and Gravel Company, Ltd., Saskatoon, Saskatchawan, Canada, is visiting friends in the States, which include producers, equipment manufacturers and Pit and Quarry. He is engaged in developing a large deposit of excellent sand and gravel 12 miles southeast of Saskatoon. That modern plant will be in operation for early spring. Mr. Fisher is very enthusiastic about the future for Canada, especially the road and construction program for 1929.

Northwestern States Elects New President

W. H. L. McCouster, of Jackson, Michigan, was elected president of the Northwestern States Portland Cement Company, at Mason City, Iowa. Col. Hanford MacNider, Mason City, former assistant secretary of war, was chosen chairman of the board of directors.

Sam D. Clinton to Manage Laramie Plant

It is reported that Sam. D. Clinton, former representative of the Monolith Midwest Portland Cement Company in Oregon and Washington has been appointed resident manager of the Monolith Midwest Portland Cement Company, with headquarters at Denver, Colorado. He will be in charge of the new $2,000,000 Monolith Midwest Portland plant at Laramie, Wyoming, which will begin operations soon.

Southwestern Portland Cement Company Expands

The Southwestern Portland Cement Company, of El Paso, Texas, is making important additions to its plant, which will materially increase the capacity. A Cottrell plant for dust collection in waste heat boilers is being installed by the Western Precipitation Company, of Los Angeles, California. An addition will be built to the power house to accommodate a new 3500 kilowatt turbine unit to be finished by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Penna. A 10-foot burning zone will be added to No. 3 kiln.

NEWS OF EQUIPMENT MANUFACTURERS

Double-Lock Mesh-Woven Manganese Steel Screens

The Manganese Steel Forge Company of Philadelphia, Pennsylvania, is distributing its 48 page illustrated Bulletin 120, entitled "Saving and Making Money with Rol-Man Screens." This bulletin points out the true importance of screens as a factor in the operating efficiency of crushed stone, sand and gravel, trap rock, slag, coke and mining plants. This importance is due to the fact that screen capacity, accurate sizing, and long screen life have a decided bearing on tonnage output, operating costs, salability of the product and plant profits.

Some of the features claimed for these screens are maximum amount of open space and fewer blind spots, greater output in revolving equipment, increased capacity on vibrating and inclined gravity equipment, much more rapid and thorough screening action and greater capacity afforded if used in existing plants. In addition, the bulletin contains endorsements by operators of various types of plants in the form of reproduced letters.

New Speed Reducer Catalog

The Farrel-Birmingham Company, Buffalo, New York, is distributing a new illustrated 24 page booklet for inclusion in the general catalog or to use independently. It describes a new series of Farrel-Sykes speed reducers from 1 to 5,000 h.p. and any desired ratio of reduction.

These reducers are equipped with Sykes herringbone gears and anti-friction bearings. In this new series, roller bearings, which have thrust and journal capacity, are used so that both pinion and gear shafts are held from end movement and at the same time protected from any end thrusts from connected mechanism. The roller bearings being interchangeable, it is possible to make the gear units interchangeable and to manufacture them in large quantities. The booklet includes charts of horsepower capacities.

Otis Engine Elects Vice-President

The Otis Engine Company of Brooklyn announces that Edwin F. Daley has entered the organization in the executive capacity of vice-president and general manager.

An Improved Truck Body

The Blaw-Knox Agitator Truck Body

The Blaw-Knox Company of Pittsburgh, pioneers in the development and manufacture of Central Mixing Plants for ready mixed concrete, have been studying for a number of years the requirements for an adequate truck body for the transportation of mixed concrete from the mixing plant to the job, and have added to their line of manufacture the agitator truck body, invented by the Graham Brothers, contractors and ready mixed concrete dealers of Richmond, Virginia.

The principle of the agitator truck body is simple. The concrete is proportioned and properly mixed by a trained operator under required supervision and inspection at a central mixing plant. The concrete is then transported to the job in the agitator truck body, designed to simply keep the concrete constantly in agitation. The method of agitation is such as to absolutely prevent any segregation for any mix, whether dry or wet, the agitating mechanism not only stirs in the circular cross section of the body, but keeps the concrete in constant circulation along the length of the body, thus insuring complete agitation.

The use of ten agitator bodies for a period of fourteen months at one of the most efficiently operated ready mixed plants in the United States has demonstrated that there is no segregation and that the concrete is more workable. Complete manufacturing arrangements have been worked out, and the agitator truck bodies are now in production at the plant.

A Two Yard Electric Shovel

The Bucyrus-Erie Company, Erie, Pennsylvania, is distributing its illustrated 20-page Bulletin E-501, which is devoted exclusively to the 50-B, 2 cubic yard electric shovel. The shovel is powered by alternating electric current that insures lower operating cost. It is said to combine all the advantages of a steam shovel with many added improvements. The Ward-Leonard control is said to be the highest development for electric shovel operation, as it gives the operator more complete conntrol and makes the machine more easily operated.

This machine is equipped with outside dipper handles which permits the use of an all-steel box girder boom. The double rack pinions, which are extra heavy and strong, transmit the load equally to both sides of the boom. The boom machinery is simple, consisting of a motor to drive the shipper shaft gears through an intermediate shaft, and crowd the dipper into the material. A clutch, which is a dependable device and will slip under an extreme load, is provided to prevent damage to the motor. For each machine, a specially designed dipper for each class of work is provided which assures greater digging efficiency and long service.

Large Capacity Portable Pump

The Pennsylvania Pump and Compressor Company of Easton, Pennsylvania, is distributing a 4 page illustrated Bulletin No. 213 entitled "Penroi Pumper." This unit is described as being light, compact and portable, designed for practical work and suitable for emergency or intermittent duty of any character.

The pump, which is of the centrifugal single suction open impeller type, is assembled with the gasoline engine and mounted on a hand truck. The casing is cast iron, of the volute type, and can be adjusted so that the discharge opening may have any one of eight positions. The head is of cast iron, accurately machined, and carries the stuffing box, which is provided with bronze water seal cage. A bronze sleeve covers the engine shaft through the pump stuffing box to prevent corrosion and wear. A graph showing the characteristic curve of performance is included among the illustrations.

Link-Belt Company Announces West Coast Appointments

When Link-Belt Company opened a San Francisco office last August, to be devoted exclusively to cranes and shovels, appointing R. B. Randall manager of the Pacific Coast division of the Link-Belt Crane and Shovel Department, with Garfield & Company their Northern California and Nevada agents, it was announced that several other appointments would follow in the Western territory.

In September, A. H. Cox and Company, Seattle, was appointed the Washington agent, and National Machinery Co., Vancouver, was appointed the British Columbia agent. The A. H. Cox and Company, organized in 1910 to do a general machinery business, in 1919 expanded and entered the construction equipment field, where it has been very active ever since that time. The personnel of the organization includes some men widely known in the crane and shovel industry—including A. H. Cox, who leads the company as president; G. H. Jamison, manager of the Construction Equipment Department, and W. F. Lewis, formerly with Link-Belt Meese and Gottfried Company. The National Machinery Company is eminently well fitted for handling the British Columbia territory, and is ably headed by Mr. Newson as manager.

The most recent one to be made known is that of the J. L. Latture Equipment Company, Portland, as Link-Belt crane and shovel agent for the state of Oregon and Eastern Washington. The J. L. Latture Equipment Company was established in 1919. It now occupies a four-story concrete building which houses offices, display sales rooms and warehouses. The organization is headed by J. L. Latture, who likewise enjoys a wide acquaintanceship.

These organizations are well known throughout the Northwest, and represent several other manufacturers who are leaders in their respective lines.

The Link-Belt line of cranes and shovels, which has been supplemented by two new models within the past year, covers a range of sizes from ¾ yard to 2 yards each equipped and easily convertible as shovel, crane, dragline, trench shovel and skimmer excavator. In addition to a full line of shovels and dragline equipment, Link-Belt manufactures railroad-type locomotive cranes in various sizes and equips them for all kinds of power—steam, gasoline, Diesel or electric.

Dreadnaught Buckets

The Blaw-Knox Company, Pittsburgh, Pennsylvania, is distributing its illustrated Bulletin, form No. 1059, which is largely concerned with the Dreadnaught buckets manufactured by the Company. It stresses such particular improvements as one piece cast head, heavy forged one piece corner bars, high carbon steel cutting lips, hardened steel pins, guide rollers and the latest improvement which is the ball equipped sheaves. All working parts are equipped with Alemite grease gun connections.

Buckets are built in "600" series, up to and including 1 cubic yard capacity, and in "700" series, from 1 cubic yard to as large as desirable. From the information in the chart included with the catalog it is noted that the series "600," or general purpose buckets, are furnished primarily for rehandling concrete aggregate and similar materials. When these buckets are used with teeth for digging, they can be equipped with a counterweight which enables this bucket to meet a broad range of requirements. The "700" series are furnished in light weight sizes for rehandling purposes or heavy weight for the hardest class of digging.

A review of the detailed information as given in the catalog will evidence that these buckets in all sizes are built to the highest possible standards. These buckets are said to be designed and built with one object in view—to insure a greater earning power. This catalog also makes reference to Bulletin 1081 which discusses dragline buckets and Bulletin 1034 which describes the direct reeved type of bucket for permanent installation.

A Concrete Carrier

The Good Roads Machinery Company, Kennett Square, Pennsylvania, is distributing an illustrated 4-page folder which describes the Good Roads-Clinton Concrete Carrier. It is said to solve a problem that has faced the pioneers in the establishment of large central mixing plants and is scientifically correct as to strength and simplicity.

It consists of a cylindrical steel tank, the inside walls and ends being perfectly smooth, and entirely free of flights, supporting shafts or obstructions. After loading, the carrier is sealed and slowly revolved until ready to discharge. The tank, supported at each end by large trunnion shafts, revolving in heavy duty self aligning roller bearings, is revolved by a cut steel pinion engaging with a gear attached to the outer circumference of the tank surface of the front end. Power is furnished by an 8 h.p. LeRoi two cylinder motor with throttle control. Clutch and gears are operated within a single casing integral with the engine housing and running in an oil bath.

Bulk Cement Conveying

The Fuller Company, Catasaqua, Pennsylvania, is distributing an illustrated 8-page Bulletin that deals with "Bulk Cement Conveying" from box car to storage and mixer bins in ready mixed concrete and cement products plants. This system of conveying is enabling customers to take advantage of the savings incident to the use of bulk cement, rather than the more expensive bagged material.

The plan, outlined, mechanically consists of one moving part with one drive which performs the three functions of conveying, elevating and distributing. The cement to be conveyed is delivered to the hopper of the Fuller-Kinyon pump and is advanced through and compacted in the pump barrel by a rapidly rotating impellor screw. Slightly beyond the screw, a small volume of compressed air is continuously admitted to create a fluent mixture of air and cement that is forced through a 3 or 4-inch diameter pipe line by the pressure of the screw and the advancing material column. Capacities of these systems are said to be limited only by the rate at which the car can be discharged.

A Zelnicker Bulletin

The Walter L. Zelnicker Supply Company is distributing Bulletin No. 379. It is mostly concerned with oil engines, Marine Diesels, oil engine generators and tanks. This company carries on hand a complete stock of new and used machinery for pit and quarries.

Trinity Portland Overhauls Dust-Collecting System

The Trinity Portland Cement Company, Dallas, Texas, has decided to make a number of changes in the dust-collecting system at its Houston plant. As a start, a complete "Norblo" system will be installed in the finish grinding mill. The rest of the departments have also been checked over in order to bring them up to the most modern standards of efficiency. The company is confident that when these changes are completed the plant will be the cleanest in the county.

Improved Speeder Model

The Speeder Machinery Corporation, Cedar Rapids, Iowa, is distributing an interesting illustrated folder to the trade. It gives interesting illustrations of different Speeder equipment and especially stresses the new Model B-3 that may be used as a shovel, pull-shovel, skimmer, crane, dragline or clamshell with no mechanical changes. Some of the improvements on this model are heavier double tread sprockets, improved tread and drive chain tightness, larger bronze bushed bearings, larger shafting and all shafts splined, insuring proper alignment and greater ease of operation.

A Three Jaw Crusher

The Bakstad Crusher and Equipment Corporation, Chicago, Illinois, is distributing Catalog No. 3-C. This 24-page illustrated publication is intended to be "The Answer to a Problem" of a crusher with a greater range; because if a greater ratio of reduction can be obtained without sacrifice to quantity or quality, fewer crushers would be reequired and this is claimed to be the crusher required. The principal features are three crushers in one, greater crushing range, increased capacity, lower crushing costs, all steel, dust proof bearings, no babbit required, reversible bearinngs, uniform tension and elimination of intermediate equipment such as screens, conveyors and secondary crushers. The publication also shows completely equipped plants that were designed and built or supervised by the Company.

B. P. Smith In Charge Chicago Office for Western

Bruce P. Smith, who has been associated with the Western Wheeled Scraper Company, and Earth and Rock Equipment Company is now in charge of their Chicago office located at 105 West Adams street, Bankers Building, Suite 1835. Mr. Smith is well known throughout the industry and will be pleased to welcome readers of Pit and Quarry to his office when they come to Chicago.

Armstrong Company Opens New Branch Office

The Armstrong Manufacturing Company, Waterloo, Iowa, has established a new office and warehouse at 1506 Mayflower Street, Harrisburg, Pennsylvania. A new building has been erected and equipped with the most modern loading and unloading facilities.

F. J. Schermer, formerly manager for the Company at Scottsville, Kentucky, is in charge of the new branch. Mr. Schermer is well and favorably known in the field and is recognized as a leading authority drilling and blasting operations.

Engines for Heavy Work

The Hercules Motor Corporation, Canton, Ohio, is distributing a 2-page illustrated folder entitled "Hercules on the Job." It designates the machine as an engine, rather than an ordinary motor, and claims efficiency for heavy work. The leaflet carries an illustration of an Orton and Steinbrenner machine, equipped with this particular engine.

A Drum Type Hoist for Car Pulling

The Weller Manufacturing Company, Chicago, Illinois, is distributing a compact illustrated folder entitled "Don't Wait on the Engine." The illustrations and text set forth the opportunity for saving time by having a Weller drum type hoist for placing the cars. This is intended for use where steel wire rope is required to move the load and when the upright capstan type, which is also described, using Manila rope, cannot perform the required duties.

Southern Equipment Moves General Offices

The Southern Iron and Equipment Company, rebuilders of locomotives, cars, shovels, etc., which for the past twenty years has had its offices in the Grant Building at Atlanta, Georgia, has moved its general offices from the Grant Building to the works at Hemphill Avenue and Southern Railway. Atlanta.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20c each. State number of patent and name of inventor when ordering.

1,695,480. Drag-line excavator. Chester D. Buoy, Erie, Pa., assignor to G. H. Williams Co., same place.

1,695,562. Cage-adjusting mechanism for crushing machinery. Charles R. Rouse, Swissvale, Pa., assignor to Pennsylvania Crusher Co., New York, N. Y.

1,696,168. Tractor steering control for revolving excavators or cranes. Leo A. Krupp, Akron, Ohio, assignor to Star Drilling Machine Co., same place.

1,695,064. Sand cleaning and reclaiming unit. Harry W. Titgen, Philadelphia, Pa.

1,696,213. Crusher. Harry J. Shelton, University City, Mo.

1,696,216. Shoveling-machine. Benjamin C. Stanhope, Denver, Colo.

1,696,219. Pulverizing - machine. Joseph Teipel, St. Louis, Mo., assignor to American Pulverizing Co., same place.

1,696,387. Crushing-machine. Paul L. Crowe, Baltimore, Md.

1,696,751. Attachment for concrete-mixers. Russell C. Burket, Pottsville, Pa.

1,696,767. Method of washing coal, ores, and other similar materials, and separator for carrying the method into practice. Leon Hoyois, Gilly, Belgium.

1,696,899. Cement. Celso P. Baccovich, Genoa, Italy.

1,696,924. Interlocked excavator-teeth. Claude Rorabeck, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago, Ill.

1,697,297. Cage-support for crushers. Oliver J. Williams, Burlingame, Cal.

1,697,311. Combination boom, bucket, and spout distributing apparatus. Oscar Frohman, Milwaukee, Wis., assignor to Koehring Co., same place.

1,697,531. Combined grizzly and ball mill. Arthur F. Levitt, Los Angeles, Cal.

1,697,536. Dipper-tooth. Walter E. Miley, Marion, Ohio, assignor to Marion Steam Shovel Co., same place.

1,697,750. Grinding-mill. Siliam Bjerre, Shive, Denmark.

1,698,172. Ditcher-carrier. George T. Ronk, Cedar Rapids, Iowa, assignor to Speeder Machinery Corporation, same place.

1,698,268. Pulverizing - machine. Paul S. Knittel, Jersey City, N. J.

1,698,421. Dipper-stick mounting. Emery J. Wilson, Cleveland, Ohio, assignor to Thew Shovel Co., Lorain, Ohio.

1,698,442. Gravel washer and separator. Andrew M. Lockett, New Orleans, La., assignor to A. M. Lockett & Co., same place.

1,698,542. Concrete-mixer. Michael Gilson, Port Washington, Wis., assignor to Kwik-Mix Concrete Mixer Co., same place.

1,698,572. Rotary screening apparatus. James Watt, Westbury-on-Trym, England, assignor to J. & F. Pool, Limited, Hayle, England.